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MONTHLY

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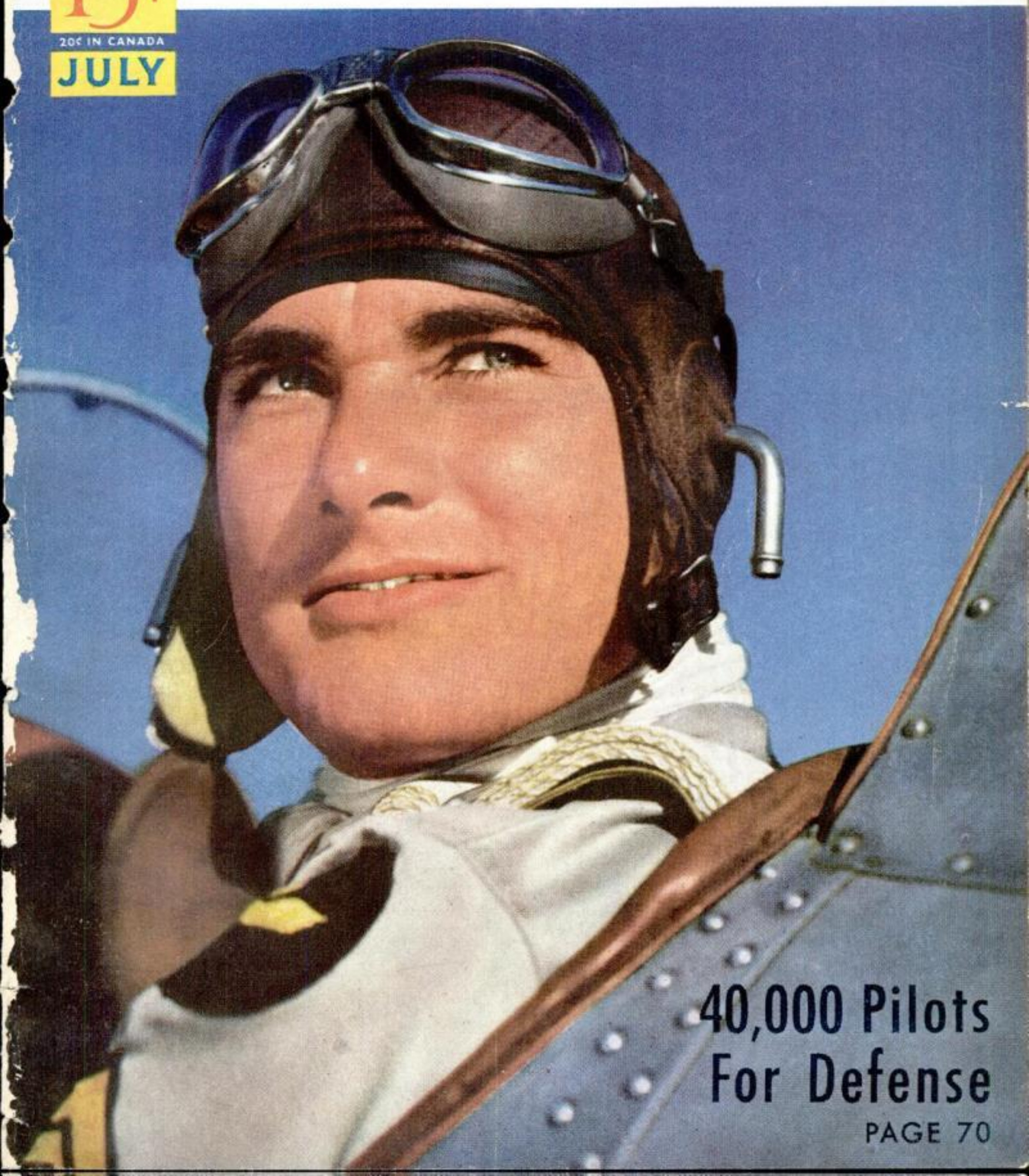


40,000 Pilots For Defense

PAGE 70

You may worry about Junior's cornet lesson

but here's one worry you can avoid

Junior's cornet blasts are jarring on the nerves and so are those first chassis squeaks that may tell of worn steering crank bearings, tie rods and king pins.

You can save yourself trouble and worry —get Peace of Mind about chassis lubrication, if you remember one word—"Marfak."

For Marfak lubricant is a special blend of heavy-bodied oils that will stick to its job at those vital points which take punishing tons of road-shock in every mile. It's cohesive and adhesive. It outlasts ordinary grease.

When you get a "Marfak job" you get Texaco's 40-Point Chassis Lubrication Service—applied by trained experts, who work by chart and not by chance.

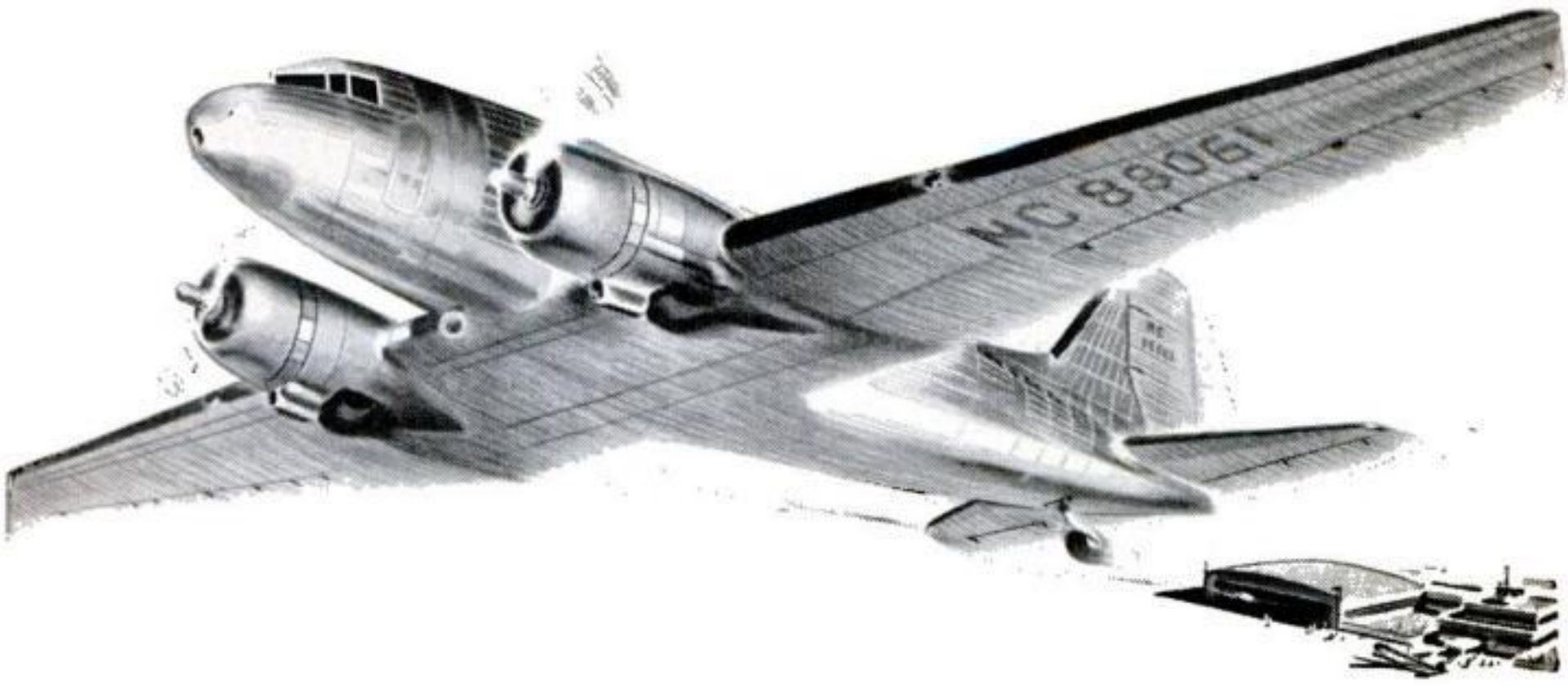
So drive in where you see this sign, "Let Us Marfak Your Car," and drive out with the Peace of Mind that no points have been missed, that your car is thoroughly lubricated. You get this service at Texaco and other good dealers everywhere.

TUNE IN FRED ALLEN

Texaco Dealers invite you to enjoy Fred Allen in the full-hour program of the TEXACO STAR THEATRE... with Kenny Baker, Al Goodman's Orchestra and a great cast. Every Wednesday Night. Columbia Network. 9:00 E.D.T., 8:00 E.S.T., 8:00 C.D.T., 7:00 C.S.T., 9:00 M.S.T., 8:00 P.S.T.

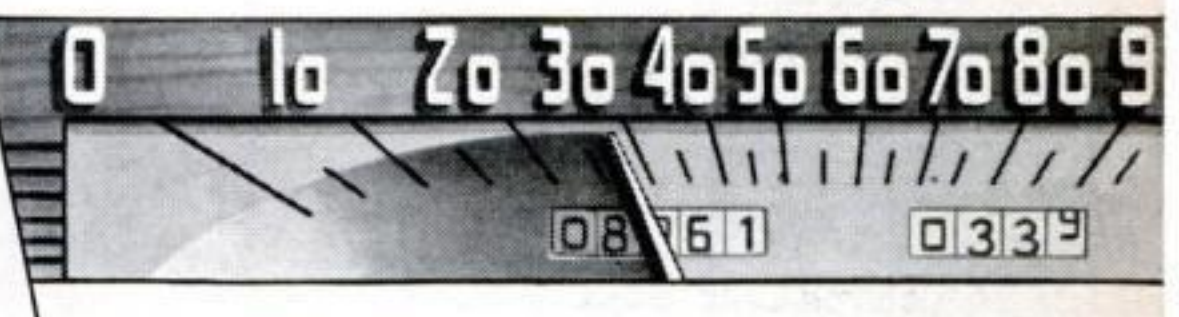
TEXACO'S 40-POINT CHASSIS LUBRICATION SERVICE AT ALL TEXACO AND OTHER GOOD DEALERS

Takes off like a transport plane!



The Speedometer tells the Story of

CHRYSLER FLUID DRIVE PICKUP!



THE *Fluid Drive* Chrysler takes off with the smooth, steady power-pull of a transport plane. No jerks...no heave-and-rest tugging...just a giant surge of power that's smooth as oil, because it's a drive through oil!

Just keep your eye on the speedometer as you tread the accelerator of a *Fluid Drive* Chrysler.

Watch that needle move swiftly...steadily...smoothly.

Without touching the gear shift lever... always in high-gear position...you move in a twinkling, without jolts or jerks, to the head of the traffic line!

Action so smooth you don't realize how swift it is unless you watch the needle. You get away like a transport plane...and like a plane with variable-pitch propellers, you cruise on a small fraction of your total horsepower...a great contribution to economy!

Try *Fluid Driving* today at the nearest Chrysler dealer's . . . and don't forget to watch the speedometer climb!

See the last word in Station Wagons... Chrysler Town & Country Car

★Tune in Major Bowes, CBS, Thurs., 9-10 P.M., E.D.S.T.

BE MODERN WITH FLUID DRIVE AND VACAMATIC TRANSMISSION— *Buy Chrysler!*

POPULAR SCIENCE

FOUNDED 1872 MONTHLY VOL. 139 NO. 1

Mechanics & Handicraft

THE NEWS PICTURE MAGAZINE OF SCIENCE AND INDUSTRY

CONTENTS *for* JULY, 1941

News

Automobiles

Home and Workshop

Departments

PAUL DORSEY, who took the color photograph on the cover, says the toughest job he ever had was picturing the war in China. Another was shooting an ice ballet in color during a performance. He did both with a Speed Graphic, using a Jacobson synchronizer. He uses General Electric No. 5 bulbs for everything, and super XX film developed in DK-50 for his black and whites.

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Single copy, 15 cents; Canada, 20 cents. Yearly subscriptions to United States and its possessions, $1.50; Canada, $2.00; foreign countries, excepting Canada, $2.50. Subscribers must notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new address.

See how you'll save some money!

New cars are few and far between for most families...and you're careful to make sure you get just the car you want! Why not take the same care in choosing a time payment plan? It's wise to figure the financing cost yourself before you buy...and it may save you money!

Just fill out and mail the coupon below. You will receive the GMAC Figuring Chart that gives you all the details of car financing in dollars and cents...shows you exactly what you get for what you pay.

In a few minutes at home you can figure your own time payment transaction on any new General Motors car—based on the amount of time you want and the amount you wish to pay monthly.

After you've figured your own "deal," *compare* various financing plans and what they offer!

Notice that the low-cost General Motors Instalment Plan includes sound insurance protection for your car!

But see for yourself...mail the coupon today! Then see your General Motors dealer.

This plan is available only through dealers in Chevrolet, Pontiac, Buick, Oldsmobile and Cadillac cars.

Send for this Chart

NO SALESMAN WILL CALL

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GENERAL MOTORS ACCEPTANCE CORPORATION Y-2
1775 Broadway, New York

Please send me copy of GMAC *Figuring Chart for the car checked below:*

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Address_____

City_____

County_____ State_____ U.S.A.

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Automobiles

Facts and Ideas

Inventions

Craftwork

Home Building

Miscellaneous

New Shop Ideas

Outdoors

Photography

(Continued on page 6)

"I judge the telephone company by the people who work for it"

A little while ago, in a Vermont newspaper, there appeared a comment on the telephone company and its people. It expresses so well the ideals toward which we are striving that we quote it here.

"I DON'T know how big the telephone company is, but it is big enough to exceed my mental grasp of business.

"But I don't find myself thinking of it as a business, even in my day-to-day contacts. Rather, my attention is on the voice that says, 'Number, please.' I find myself wondering if that voice is feeling as well as it always seems to, or if it feels just as hot and weary as I do, and would say so if it wasn't the kind of voice it is.

"The first time the business angle really struck home was when I read that my friend Carl had completed thirty years with the company.

"Now it happens that I know something of the details of those thirty years with the company, and I believe they are a credit both to Carl and to the big business for which he works.

"In 1907 Carl was a high school boy confronted with the need for earning money in his spare time. He happened to get a job as Saturday night operator in the telephone exchange. He worked at this job for three years and then entered the university.

"After graduation, he was hired full time by the telephone company, not in an 'executive' position which some folks think goes with a college diploma, but as a lineman.

"Within a year he was made wire chief of the district, a job which he held for the next ten years. He was then transferred to a larger city as manager of the office — then promoted to sales manager of the division.

"A year later he was sent to another State, as district manager. In less than a year, he was made manager for the entire State.

"I don't know much about the telephone company as a business; I can only judge it by the people who work for it. Just where the dividing line is between a business and the people who work for it, I don't know. I don't think there is any line."

Bell Telephone System

"The Telephone Hour" is broadcast every Monday. (N. B. C. Red Network, 8 P. M., Eastern Daylight Saving Time.)

For championship engine performance, maximum economy and dependability on your vacation tour, make sure your spark plugs are Champions—the spark plugs champions use!

WHETHER YOUR VACATION tour takes you to northern lakes and streams or "down Mexico way", your car will perform better if your spark plugs are dependable and in first-class condition.

So to be sure of carefree motoring have your spark plugs tested before setting out on your vacation tour. If they are worn out, of inferior quality, show leakage under pressure, or have been in service in excess of 10,000 miles, have a set of new Champions installed. They will soon pay for themselves in gas saved, renewed power, speed and better all around engine performance.

The Sillment seal outstanding among Champion's patented features, eliminates troublesome leakage *common to ordinary spark plugs.* Leaky spark plugs overheat, causing pre-ignition and rough, unresponsive engine operation. Insist on Champions—the spark plugs champions use.

You're always ahead with Champion!

Contents [CONTINUED]

Radio

Shop Data File

The Handy Man

Woodworking

O'MALLEY: *Another what, Callahan?*

CALLAHAN: *Another man that's switched to Goodrich.*

O'MALLEY: *And is* that *a crime?*

CALLAHAN: *Sure not! And if it were, 'tis half the town would be in jail, I'm thinkin'.*

IF IT'S real protection you're looking for, here's the ticket—do as so many other careful drivers are doing—put Silvertowns all around. They'll give you full protection against blowouts and skids . . . and pay you a dividend of extra miles by the thousand. Those extra miles are put into every Silvertown tire by Duramin. That's the amazing "tire vitamin" discovered by B. F. Goodrich scientists. Duramin keeps rubber young and lively—gives you more *safe* miles on Silvertowns.

It's dangerous to squeeze the last miles out of worn tires. And it's unnecessary, too. Trade-in allowances are high, prices are low. See your dealer!

SEE THE NEW SILVERTOWNS

(*Left*) **SAFETY SILVERTOWN.** Top-quality Hi-Flex cords make it stronger than ever. Duramin gives it thousands of extra miles.

(*Center*) **DELUXE SILVERTOWN:** Best possible combination of mileage, safety, comfort. New safety tread smothers road noise to a whisper.

(*Right*) **LIFE-SAVER SILVERTOWN.** Extra miles—20% more than the original Life-Saver tread tire. No tire can stop you quicker, keep you safer from skids.

Coming Next Month—

DEFENSE is the watchword in America today. Millions of men and billions of dollars have been put to work to make our country secure. Vessels are sliding down the ways of our shipyards; planes and guns, tanks and shells are pouring off the production lines of our factories.

POPULAR SCIENCE MONTHLY for August will be devoted largely to giving our readers a comprehensive picture of the greatest industrial mobilization in the nation's history. Telling photographs and fact-packed articles will bring you the story of this many-sided effort that affects all of us.

Ray Millholland will tell how industry is turning out the machines that make the tools of war. Another article will describe the job of housing the millions of workers and soldiers, using everything from prefabricated buildings to trailers. Military authorities will outline the efforts being made to give our Army new speed and fire power.

Lieut. Col. A. M. Prentiss, foremost American authority on chemical warfare, will tell what precautions our Army is taking to guard itself against gas attacks. Hickman Powell will describe the intricate communication system that links the various parts of the fast-moving military machine. Aviation developments in both the Army and the Navy will be reported by C. B. Allen. Edwin Teale will take you into tiny factories that are doing their bit to help.

America is racing against time, with her future as the stake. The August issue of POPULAR SCIENCE MONTHLY will give you an up-to-the-minute report on the progress of this momentous effort.

THE EDITORS

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FLUID DRIVE...

A STATEMENT BY CHRYSLER CORPORATION

Gasoline and Diesel engines are making history. The very defense strength of nations is now measured in motor power. Combat plane, bomber, submarine, torpedo boat, oceanic freighter —tank, truck and military car—all are motor driven.

And in this vast field of mobile horsepower, Fluid Drive has revolutionized all previous conceptions of harnessing internal combustion engines. This new development of a time-tested basic principle provides smooth, vibrationless power transmission.

An Aid To Defense

New applications of Fluid Drive are expanding its usefulness. It is indispensable wherever the flow of power calls for flexibility, instantaneous absorption of terrific impulses, peak engine torque and an absence of vibration. Where split-second timing is demanded, the Fluid Drive principle answers a vital need. A tiny Fluid Drive unit controls the speed of airplane superchargers—giving motors a regulated air supply at high altitudes and preventing disastrous vibration.

In submarines, Fluid Drive permits multiple Diesel Engine hook-ups—cushions volcanic power explosions —even disconnects the engines from propellers in three seconds—a necessity when submerging. Power-shovels now use it to absorb the shock of impact and prevent engine stall. It is solving countless other industrial and utility power problems.

Exclusive of automobiles, the Fluid Drive principle transmits over four million horsepower throughout the world today—energy equal to the combined installed capacity of Boulder and Coulee Dams. Already, Fluid Drive is transmitting well over thirty million horsepower in the motor cars produced by Chrysler Corporation.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

A Basic Principle

Fluid Drive has taken its place as a basic principle of power transmission —along with the lever, the inclined plane, steam, electricity and hydraulics. Its principle is an established law of physics—kinetic energy—which is force through motion. Engine power is transmitted through spinning oil. There is no metal to metal contact between motor and drive shaft.

For 25 years, automotive engineers have sought a means of providing acceleration without the bother of gear shifting—to cushion ever-increasing horsepower with the smoothness of steam and the quiet of electricity. Fluid Drive is the final key to this accomplishment. After years of research by Chrysler Corporation engineers, Fluid Drive was introduced in 1938 on the Chrysler Custom Imperials—it since has been made available on all 1941 Dodge, De Soto and Chrysler models.

A new ease of car control—of distinct advantage under present-day traffic conditions—is provided by Fluid Drive. The motorist can stop, start again, speed up, slow down—drive all day without the continual effort of gear-shifting. Acceleration is smooth, vibrationless!

A Major Achievement

Fluid Drive adds new safety. The danger of engine stall is practically eliminated! On slippery, icy pavements Fluid Drive gives the car a more sure-footed action. Traction is obtained by the cushioned flow of power to rear wheels. Yet, with all these important advantages the motorist has nothing new to learn about driving.

Over 300,000 owners of Dodge, DeSoto and Chrysler cars are enjoying the benefits of Fluid Drive. Like Hydraulic Brakes and Floating Power —two other Chrysler Corporation achievements—Fluid Drive is a major, permanent contribution to motoring comfort and safety. It creates a new high standard of automobile performance and value. It is truly a modern miracle of motor power transmission!

★ ★ ★ ★ ★

PRODUCTS OF CHRYSLER CORPORATION

ARMY TANKS • ANTI-AIRCRAFT GUNS • AIRCRAFT PARTS • ARMY VEHICLES • PLYMOUTH, DODGE, DE SOTO AND CHRYSLER CARS • DODGE TRUCKS • MARINE AND INDUSTRIAL ENGINES • DIESEL ENGINES • OILITE BEARINGS • AIRTEMP HEATING AND AIR-CONDITIONING EQUIPMENT

YOU GET THE GOOD THINGS FIRST FROM CHRYSLER CORPORATION

From the News Editor's Desk

VAPORS FROM AN ORGANIC COMPOUND named beta naphthoxyacetic acid, released in a small greenhouse where tomato plants were about to bloom, induced the formation of high-quality, luscious tomatoes without seeds. The compound's crystals were first melted, and then warmed slightly over an electric hot plate; the very slight vapor resulting caused every plant in the place to set fruit. Dr. P. W. Zimmerman, of the Boyce Thompson Institute, Yonkers, N. Y., where the experiment was conducted, reported also that the acid produced other strange effects which may have wide practical application in greenhouse culture. Plants watered with a weak solution of the acid formed tubular flowers that would not open. But they set seedless fruit after they had been treated with the acid.

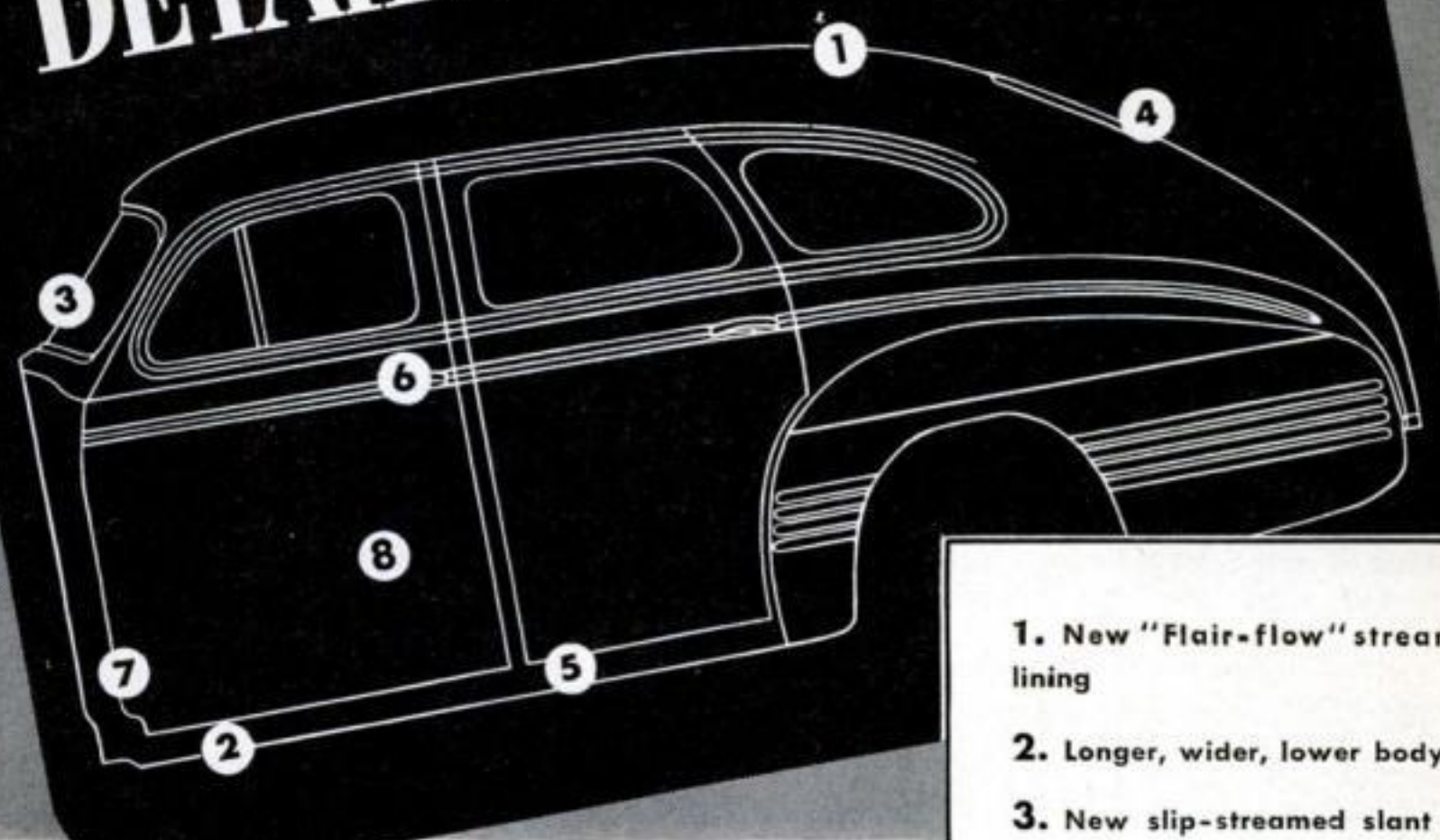
MEASURING THE SPEED OF LIGHT has been a favorite scientific activity for years. Now Dr. Wilmer C. Anderson, using a photo-electric cell, automatic recording devices, and mirrors, has placed the new value at 186,272 miles per second, which may still be 8.7 miles per second in error. This is 12 miles per second less than the value previously established. Dr. Anderson made his determinations while at the Cruft Laboratory of Harvard University.

PRESSED FOR CARGO SPACE, the British have begun making fireproof fabrics from seaweed. Abundant supplies on the west coasts of Scotland and Ireland are transformed into alginic acid, and thence into alginates, whose fibers have good luster and strength. The new fabric is reported to cost less to make than viscose rayon.

INSTEAD OF USING purified vegetable and animal fats in the manufacture of glycerin, Dr. Richard S. Shutt, of the Battelle Memorial Institute, Columbus, Ohio, has devised a process utilizing available raw materials such as petroleum-refinery gases. The Shutt process produces no undesirable by-products, it is said, and gives a high-grade product essential both in the manufacture of explosives and plastics.

A PORTABLE QUICK-FREEZING UNIT that will enable small farming communities and ordinary fishing boats to quick-freeze their products on the spot has been perfected by Luis H. Bartlett, University of Texas engineer. Peas, shrimp, grapefruit segments, or other foods are frozen in a heavy fluid moving slowly through a nine-inch pipe. A slowly turning screw pushes them along, and also scrapes the sides of the pipe to prevent ice crystals which might clog the machine. The food is easily handled and packaged, because it emerges in separate pieces rather than in solid blocks. The unit costs $1,500 and measures five by five by eight feet. The University itself will manufacture the machines and lease them to users.

DETAILS OF BEAUTY



1. New "Flair-flow" streamlining
2. Longer, wider, lower body
3. New slip-streamed slant to windshield
4. New double-curved back window
5. Concealed running boards and door hinges
6. Streamlined door handles aligned with belt molding
7. Doors hinged at front for greater safety
8. Wider door entrances

NO other cars have all the brilliant new style features the 1941 Unisteel Turret Top Body by Fisher provides. Some of these features are shown in the panel on the right as they apply to the Pontiac Torpedo Streamliner Eight Sedan. And even from this partial list, it's evident that no new styling job was ever more complete. Every detail has been made to conform with the new, more advanced streamlining of the entire body—from windshield to trunk back and roof to floor. So naturally, the word's going round that "Body by Fisher is '41's guide to better value"—which leads you, of course, to a General Motors car.

"It's Another Big Year for Pontiac"—and a big reason, certainly, is its new Body by Fisher, pictured here on the 1941 Pontiac Torpedo Streamliner 8 Sedan. Sleeker yet roomier than ever, it has foam rubber seat pads, a larger luggage compartment, a 2½" wider front seat.

UNISTEEL TURRET TOP

BODY BY Fisher

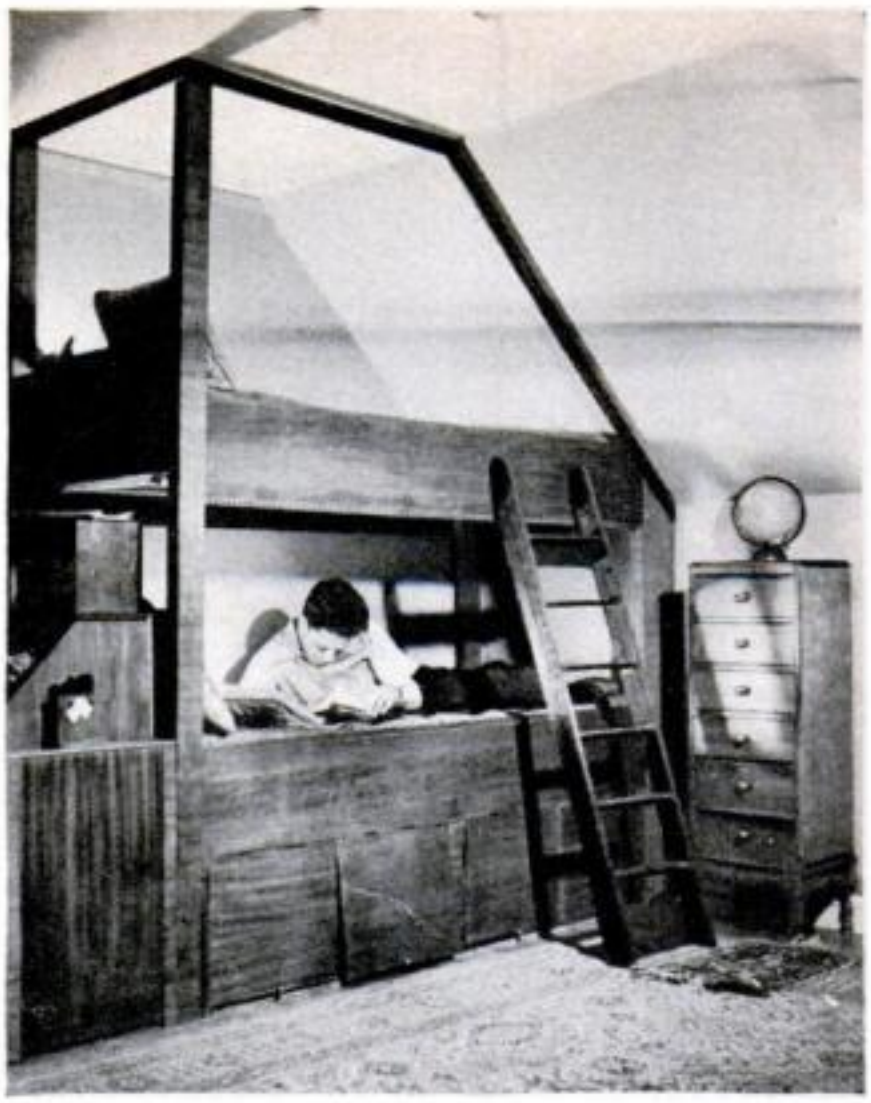
GM GENERAL MOTORS

ON GENERAL MOTORS CARS ONLY:
CHEVROLET · PONTIAC · OLDSMOBILE · BUICK · CADILLAC

Readers Say:

Another "Room for Bobby" Built from an Old Chest

When Dr. M. J. Lossow, of the Bronx, New York City, read Clifford McBride's article "I Build a Room for Bobby" in the March issue, he thought the idea of a nautical boy's room was a clever one, and decided to try it himself. The photograph shows the result. For lumber he took apart an old chest, so that the only cost was about $5 for varnish and nails. Dr. Lossow has built a lot of things around his house, and a previous construction job in the kitchen was photographed for publication in a utility house organ. The boy's room was built in spare time and finished in two weeks.—R. M., New York City.



This shipshape boy's room was built by Dr. M. J. Lossow. Cabinets under the bunk provide storage

Can Anybody Beat This Record for a Penny-Balloon Flight?

Like many others in the general science classes of my school, I have been sending up toy balloons filled with hydrogen gas. I seem to hold the record around our town by sending one all the way to Crosstown, Mo., about 500 miles away, in 14½ hours. I sent it up about 7:30 p.m. one day, and about 10 the next morning a dog found it in a field near Crosstown and brought it to a farmhouse. I had attached a note asking that the finder communicate with me, and the farmer did so. I'd like to know what is the record for penny balloons like my own. —J. A. F., Lincoln Park, Mich.

This Hits the Hypothetical Nail on the Hypothetical Head

The request of J. S., of Corona, N. Y., for a formula to predetermine the strength of a bow recalls a plea I once made for help in solving a problem in ballistics. Enough formulas and calculations came in to sink an M. I. T. professor. They had only one thing in common: they were all wrong. A slide rule can be a snare and a delusion. It might be possible to prove by calculus that a six-foot, two by two-inch white-oak stave bent to a 180-degree arc would propel a two-ounce arrow 623 yards—which would be fantastic. As an archer, J. S. must know that two bows of the same wood and identical dimensions would not only have an entirely different cast, but that each bow varies from hour to hour from relative differences in temperature and humidity, and according to the length, weight, shape, and feathering of the arrows used. The improved American type of bow was developed by long, careful practical experiment, not by Hookes' law (whoever *he* was). Calculating the cast of a hypothetical bow shooting a hypothetical arrow is about as practical as estimating the contents of a woman's handbag by geometry.—P. St. G., Coconut Grove, Fla.

Just Don't Leave the Pieces Lying Around the House

You have lately been printing a lot about cyclotrons, molecules, and atoms, but the last few months you slacked up. How about some more? And while you're at it, how about showing us how we could build a home cyclotron? I sure am getting eager to do some atom-busting myself.—B. C. P., Jr., Sulphur Springs, Tex.

This Bottle Neck is Your Opportunity

A very real bottle neck has occurred in industry.

The millions of men going to work in the defense industry and business boom need thousands—hundreds of thousands—of supervisors and executives. Expanding Government agencies are calling for many specialists. Regular business needs experts to take care of expansion and to replace men called to military service.

The need is for all sorts of executives and specialists—foremen, supervisors, superintendents, accountants, traffic men, tax experts, time keepers, department managers, auditors, cost experts, production men, etc. The need will grow and continue for years to come.

There just are not enough men ready for these places nor can industry take the time to train them. Thousands—scores of thousands—must get their own training.

That is your opportunity—if you are ready or will get ready quickly. Never again will you have such an opportunity to command the success you want. But you must act decisively—immediately. The more quickly you get ready, the sooner these millions of new workers will be pushing you up the ladder.

And LaSalle Offers You Just the Help You Need

Our courses are practically built to order for this opportunity. Condensed, practical—the minimum of theory and the maximum of practice. Prepared for spare time study—you can go as fast or slowly as you wish. You need not wait until you finish—what you study tonight, you can use on the job tomorrow. All are specialized, executive training courses. They are moderate in cost and easy terms are available.

Some of our training programs may cover just the field in which you see opportunity. Read them in the coupon below. Then check the one about which you wish full information—and mail the coupon today. Remember—the sooner you start, the sooner you will be ready for the opportunity.

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Name.....Age.....

Address.....

Present Position.....

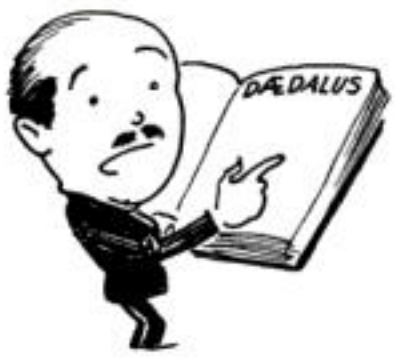
Readers Say:

More Sartorial Suggestions for Dressy Lathe Operators

TUCKING the end of your four-in-hand tie into your belt while working at a lathe, as suggested by L. H., is better than wearing the tie loose, but this partial protection may be lost if the belt slips or the tie is accidentally pulled out. And so, if a tie *must* be worn, why not specify a wide belt extending from the chin to the waist, with a sandpaper lining to grip the tie? If this is too much bother, I suggest that the decoration be tied at the back of the neck. It may be difficult to do, and the wearer may not know whether he is going or coming, and may inadvertently back into the trash box. As a final suggestion, he might wear a dickey, with the tie neatly painted on. But if he is an indifferent fellow, like this writer, he will take the tie off altogether.—W. F. W., Los Angeles, Calif.

Reader Says Wright Is Wrong as Inventor of the Airplane

IN YOUR Science Stunts article for May, you mentioned the pendulum of Foucault, at the Pantheon in Paris. You should have mentioned also the airplane of Robert, at the Museum of Arts and Trades, also in Paris. The Wright brothers may have been the first to really fly, but it is not correct to say that they invented the airplane, because Farman was experimenting with his own machine at the same time, and Robert had been flying at least 50 years before. Perhaps you would not call that real flying, because the wheels would touch the ground again after a few hundred feet in the air. It is nevertheless a real airplane. The craft is a multiplane made of wood, and the engine was much too heavy. The inventor, having spent all his money, had to abandon his pet idea, as no one wanted to help him.—A. L., Newcastle, Calif.



Catching poisonous snakes . . . then milking them of their death dealing venom is the dangerous occupation of E. R. Allen of Silver Springs, Florida. Because, strangely enough, the orange colored venom of a diamondback, for instance, is one of medicine's greatest blessings to mankind. Properly processed it kills pain . . . helps diseases like arthritis and sciatica . . . and controls that dread of all surgeons, haemophilia. *Popular Science on the screen* tells this dramatic story of science turning death into life at your local theatre. Don't miss it!

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Readers Say:

Those Venetian-Blind Slats Would Make Fine Yardsticks

HAVE you ever been given a yardstick by a business man, with his advertising on it? Have you taken that misprinted, warped piece of soft wood and tried to measure and draw some *straight* lines with it? If you have, you will know that it just cannot be done. I have avoided this crooked or wavy work by using a good folding rule for measuring and a Venetian-blind slat as a straightedge. If some one would combine the two, it would be an inexpensive timesaver for home craftsmen. That's my suggestion to J. L. Z., who is bothered by the waste of left-over slats. Why not bundle up the extras and sell them to a remembrance-advertising company? Ruled and stamped with advertising, they would make grade-A rulers and yardsticks. The holes or slots in the slats are not a drawback, either, as they make it easy to hang up the yardstick.—R. A., Morris, Minn.

Many other uses for Venetian-blind slats were suggested by readers.—Ed.

His Barber Was a Sharper, So He Sharpened His Own

ATTENTION W. H. H., Roanoke, Va.: Suggest you do not take Ed.'s advice about going to your barber to learn how to sharpen your straight razor. Your barber will probably tell you what mine told me: "I'll sharpen it for you for a quarter." That's all the satisfaction I got, so I experimented for myself. Here is my method: Clean strap with lather and dry well. Then put on some good talcum powder. Hold razor at about 45-degree angle and strap not too tight, and use some elbow grease. My old straightedge is so sharp the whiskers drop off before it hits them, from sheer fright.—G. N., Toledo, Ohio.

With the Inventors

ELECTROCUTING WHALES has been found an effective and humane way of killing them. Aboard the whaling boat, a powerful electric generator produces the necessary current. One side of the generator is "grounded" to the sea. Electricity

from the other side is led, through a cable bearing a metallic strand, to the harpoon. When the quarry is within range of the harpoon gun, the missile is fired. A square hit instantly completes the circuit through the whale's body and the sea, dispatching the animal before it can plunge into the depths. In a special harpoon line recently invented for the purpose, an insulated electric conductor forms the core, so that no other means are required for attaching it. Inner and outer wrappings are of yarn, twisted with different pitch so as to distribute the strain evenly throughout the cable. . . . IF A MINE RESPIRATOR seems a thing of beauty to its designer, far be it from the Patent Office to gainsay him. And so, to William P. Yant, of Pittsburgh, Pa., it recently has issued a series of design patents covering "The ornamental design for a gas mask, as shown." . . . THERE'S NO CAP TO LOSE, or drop down a drain hole, in a shaving-cream tube designed by Raymond C. Rupp, of Kendallville, Ind. Squeezing the tube ejects the contents through a C-shaped slit in a thick disk of sponge rubber, which may be used as an applicator if desired. Because of the material's natural springiness, the slit is self-closing. Similar containers are

(Continued on page 22)

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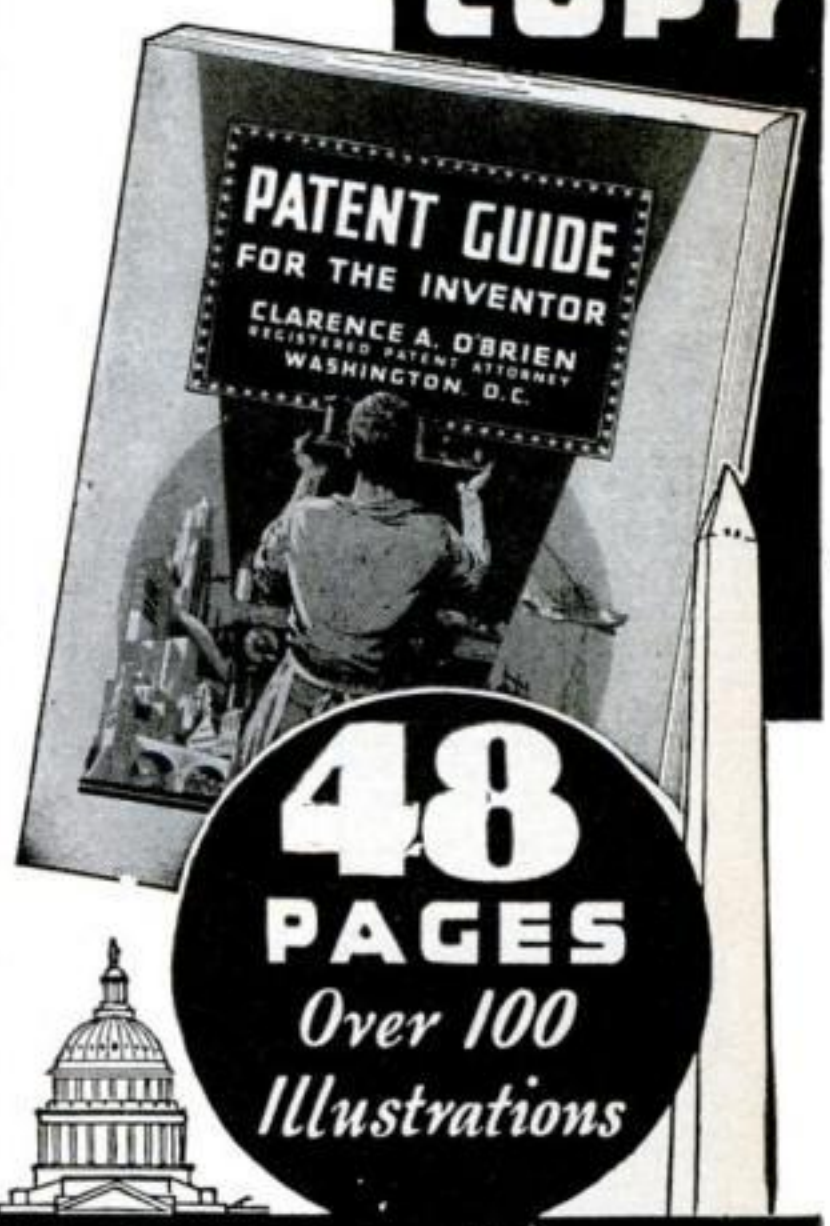

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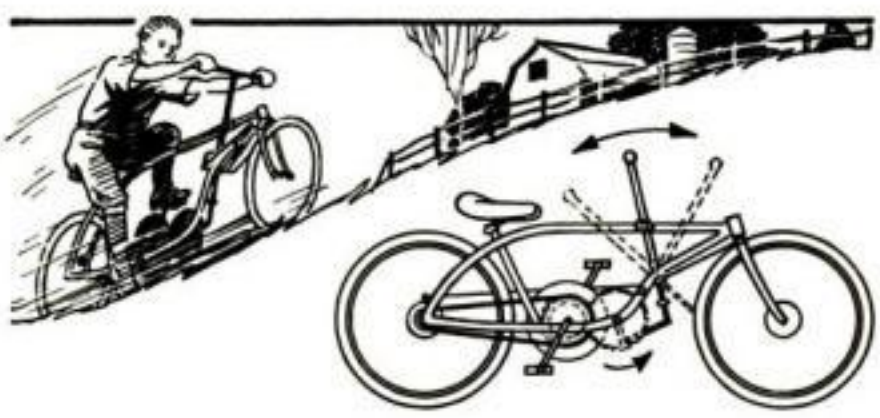
With the Inventors

(Continued from page 20)

recommended by the inventor for shoe polish, mechanics' soap, ointments of various sorts, and dressing for fishing lines. . . . BY COMBINING A SAWHORSE with quick-acting vises, William Wertz, of South Gate, Calif., offers a convenient new aid to the handy man around the house. Turning the hand wheel of either vise rotates a screw threaded in opposite directions at its ends, so that the movable front jaw advances toward the stationary rear jaw at double the usual speed. Thus a board may be clamped to the sawhorse in a jiffy for planing or other work.

AFTER NINETEEN MONTHS OF WARFARE, England still was paying Germany for the use of Nazi patents. British concerns argued it was cheaper to renew existing rights abroad than to obtain new ones at home. Stranger yet, the procedure has had the official sanction of the Trading with the Enemy Act. . . . EXTRA POWER FOR CLIMBING a steep slope is built into a bike designed by Raymond O. Letch, of Waterloo, Iowa. When pedaling becomes too hard, the cyclist gives himself a boost by pumping the handlebars back and forward. This automatically engages an auxiliary drive, so that the bicycle will be driven by the combined force of the rider's arms and legs. No difficulty is encountered in steering, the handlebars being



turned as usual regardless of their position. Through a pair of steering arms, this rotates the front fork in its journaled head. When the auxiliary drive is not being used,

(Continued on page 24)

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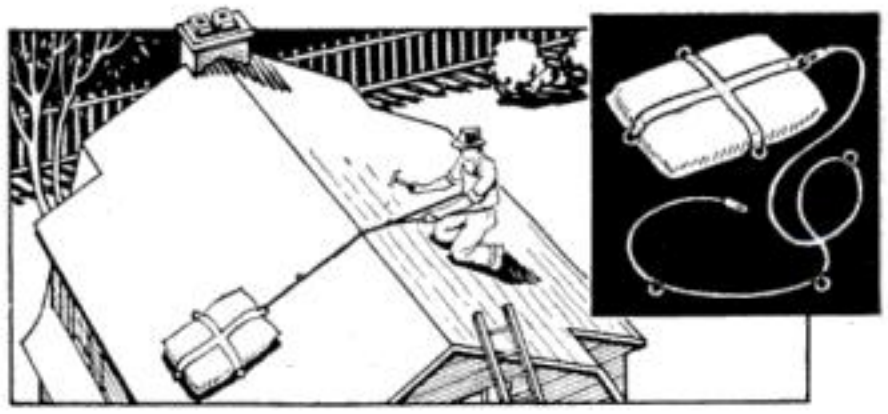
With the Inventors

(Continued from page 22)

the handlebars are latched at a point about midway of their stroke. . . . HOW NOT TO FALL OFF A HOUSE, when you're painting or repairing a roof, is a problem neatly solved by Hermann Brecht, of Union, N. J. Up where the work is to be done, the user of



this invention simply tosses a sandbag across the peak of the roof to the opposite side. From webbing surrounding the bag, a sturdy rope leads back to the worker, ending in a loop of adjustable size that encircles his waist. With the aid of friction, the outfit thus forms a perfect counterbalance, and still allows the user complete freedom of movement. When he reaches the end of his tether, the bag is easily hitched along. According to the inventor, his safety device can be employed to advantage on all kinds of roofs, such as shingle, tile, or slate, and becomes especially useful when the housetop is slippery or steeply pitched. . . . SIDE BY SIDE, a pair of children may enjoy a frolic on a seesaw of recent invention. Instead of being placed at opposite ends of a plank, the seats are mounted alongside each other on separate bars. These are connected at their ends with a series of links, as shown in the illustration, so that one child goes up while the other is coming down. Substantial legs resting upon the ground prevent the novel seesaw from capsizing. . . . IF YOU WANT to patent an improvement upon a bicycle, a printing press, or any other existing machine, your application must spe-

(Continued on page 26)

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With the Inventors

(Continued from page 24)

cifically distinguish between what is old and what you have contributed. Beyond this, the description, drawings, and claims should cover only your improvement and the parts with which it necessarily interacts. . . . WHEN LONG-RANGE BOMBERS undertake missions beyond the flying radius of fighter escorts, they must rely upon their own guns for protection. One of the most difficult problems of military designers has been to arrange these guns so as to leave no "blind spots," or vulnerable areas in which an attacker cannot be fired upon, especially near the tail of the plane. John C. Sanders, of Seattle, Wash., does the trick by disposing three guns in streamline turrets, spaced symmetrically around the cross section of the fuselage. The result is a virtually unbroken field of fire, by entering which a would-be attacker risks disaster, as depicted above. . . . RADIO MUSIC flows more sweetly from globular loudspeakers, maintains the inventor of the model pictured here. The top of its spherical diaphragm is anchored by a vertical rod, from the inside, while the lower end terminates in a moving coil. Radio impulses drive the coil up and down, making the globe alternately swell and shrink. At each pulse it emits an audible sound wave. Corrugations in the sphere help to make it

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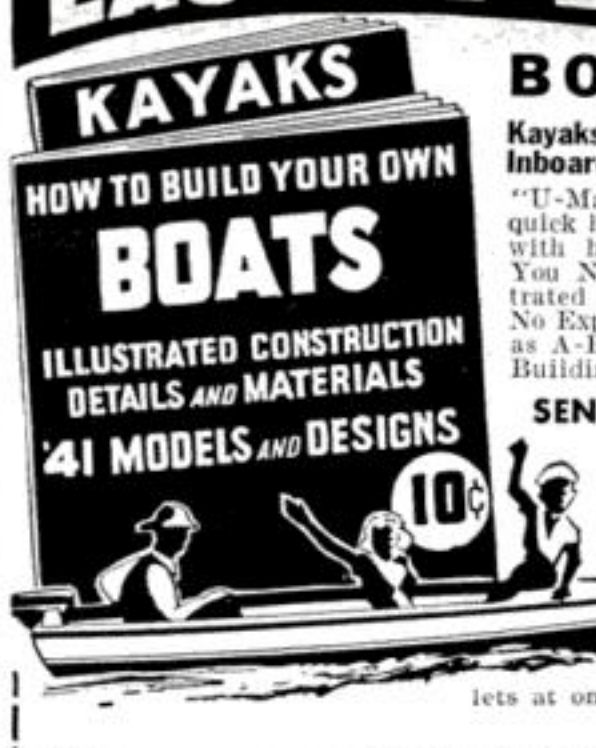

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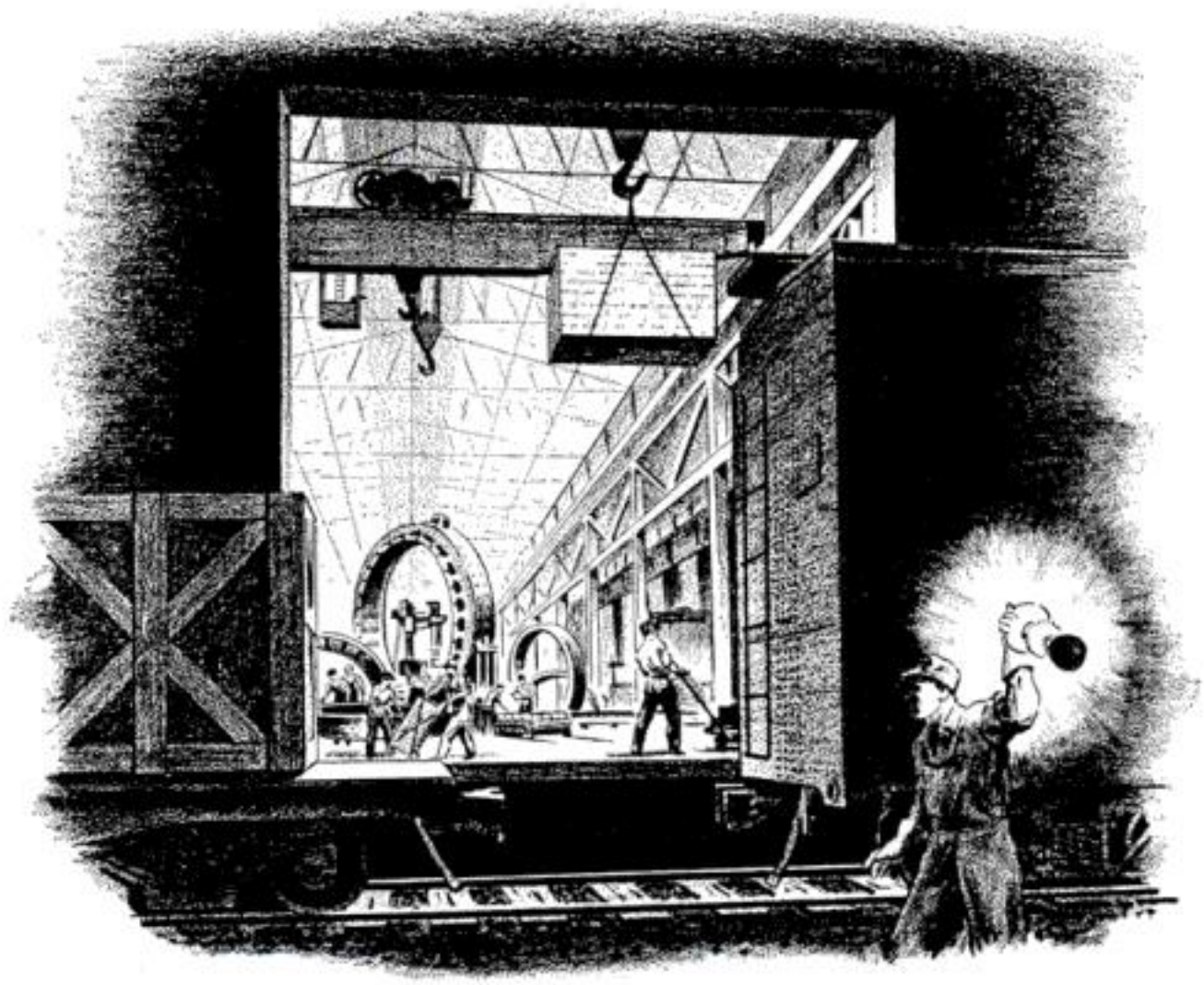

Out of the Night

IN LOS ANGELES it is eleven o'clock; in Detroit, one; in Schenectady it is two o'clock in the morning.

But tonight, there's a day's work to be done in America. In Los Angeles, Detroit, Schenectady, men are at work. They are building bombers in Los Angeles, tanks in Detroit, generators in Schenectady.

Listen! You will hear them: staccato beat of rivet guns . . . crackle of welding torches . . . harsh whisper of turning lathes. The sounds of America working!

Look! You will see them: factory windows ablaze at night . . . long freights rolling by in the twilight . . . somewhere in Newfoundland six bombers, motors idling, poised eastward on a runway in the gray dawn. The signs of America producing!

Many men, many places, three shifts. But *one* job—to make America secure.

Different machines, making different things. But behind them all *one* universal force: electric power—turning lathes, joining metals, providing a changeless, universal light.

For more than 60 years electricity has been the power that makes all work kin. In itself one of the major industries that have contributed so much to American life—contributing now in its own right to national defense—electricity is today vital to all the others as they labor "all-out" in America's defense. General Electric Company, Schenectady, N. Y.

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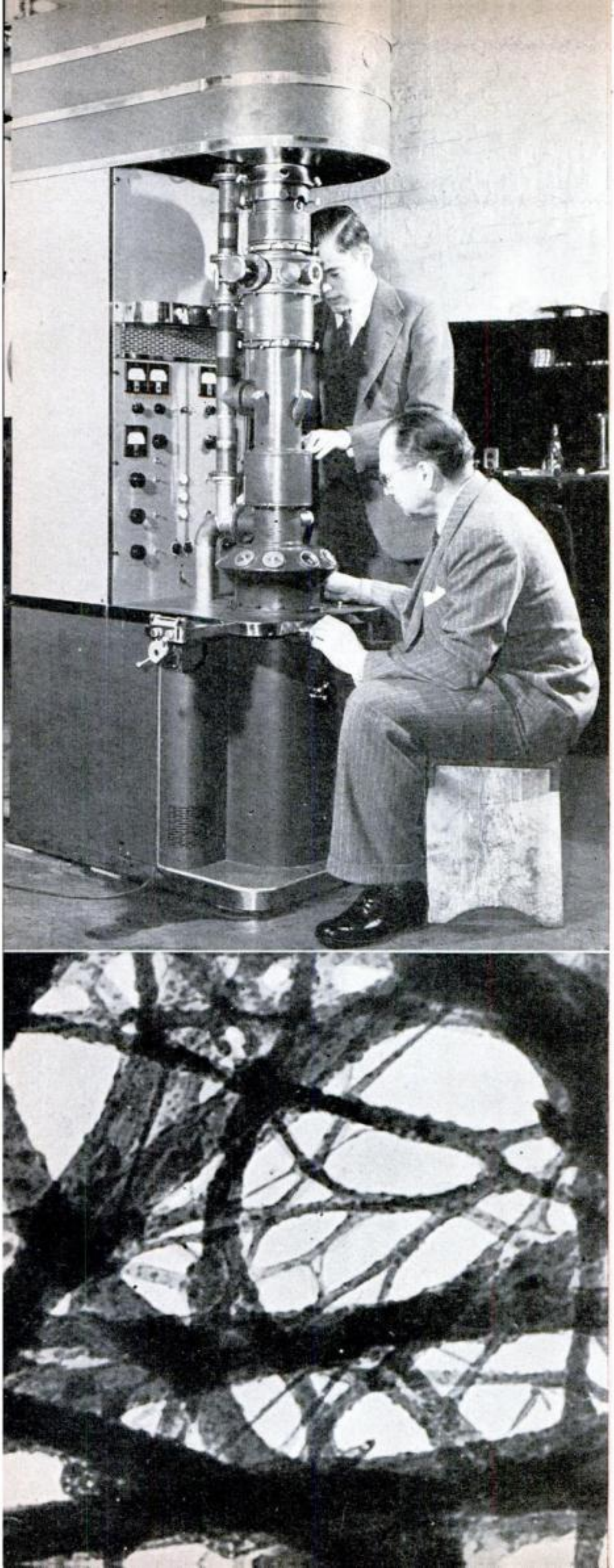


Seeing The Invisible

The Electron Microscope Solves Industry's Puzzles By Revealing Many Things No One Has Seen Before

By ALDEN P. ARMAGNAC

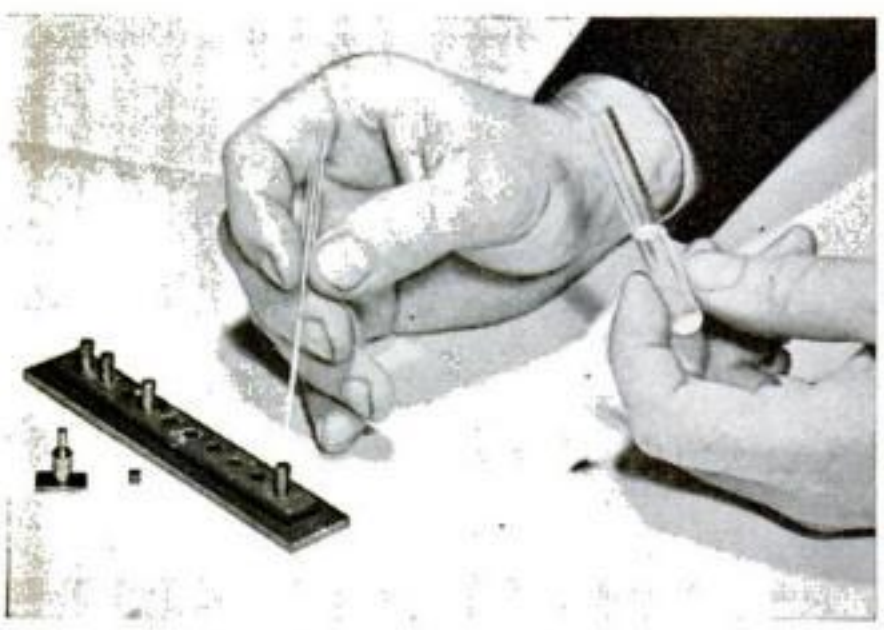
A NEW commercial model of the electron microscope, perfected by the Radio Corporation of America, recently solved its first industrial problem.

White pigment is used to coat paper like this, so that photographs will reproduce well. One standard pigment is precipitated chalk. A Stamford, Conn., manufacturer thought he had a better one in natural calcite rock, ground to tiny particles. Could his research laboratories back him up? Fine optical microscopes showed no appreciable difference between the pigments at 2,000 diameters, their utmost power of magnification. But the Stamford technicians possessed the first commercial RCA electron microscope, employing a beam of electrons instead of light, focused with magnetic coils instead of lenses, and fifty times as powerful as the best light microscopes.

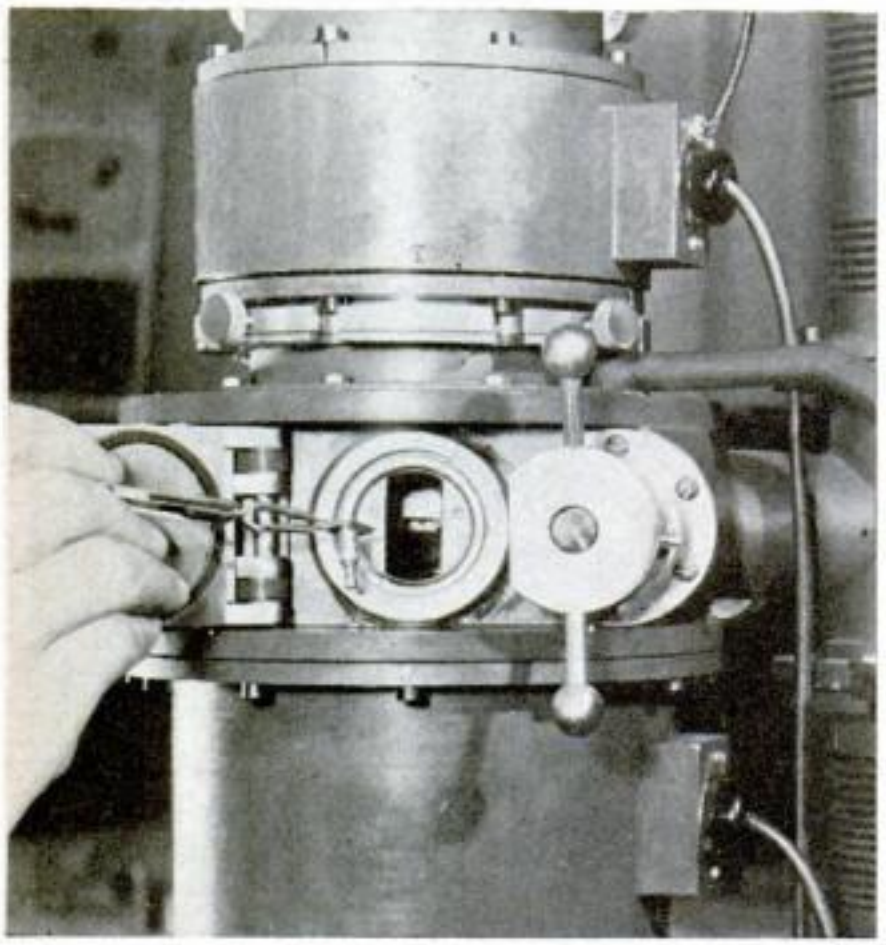
Clearly visible when magnified 36,000 times, the structure of precipitated chalk, formed of slender crystalline prisms, looked as porous as a blotter. In contrast, fragments of the ground calcite rock

SOAP looks like this when magnified 35,000 diameters by the new electron microscope for university and industrial laboratories, above

Slides for the electron microscope are circles of metal screening ⅛ inch in diameter, here compared with slide and cover glass of optical microscope



Coated with collodion, which is "transparent" to electrons, the slide receives specimen as shown. Then it goes into the brass capsule at far left



. . . which is placed in the microscope through an air lock that preserves the vacuum in the instrument. Watching the magnified image on a fluorescent screen, the observer at right turns a knob to shift the slide to the position desired for photographing

proved to be a dense, relatively non-absorbent material. Since the new pigment would soak up less casein, the adhesive used to bind it to paper, the manufacturer successfully launched his brand upon the market.

On the opposite side of the continent, a maker of insecticides found by experiment a preparation especially effective for spraying orange groves. Specimens later photographed under the electron microscope, at a magnification of 44,000 diameters, at once told why. The preferred preparation dried in thin plates, covering much greater surface than the others. If the maker had used the new research tool in the first place, he would have spared himself much labor.

Neither of these tests required anything like the full power of the electron microscope, whose amazing photographs can be enlarged to give clear definition at 100,000 diameters or more. A human hair magnified to the same extent would be as thick as the biggest tree trunk. Here are some of the strange sights the microscope reveals:

Ordinary soap, the solid-looking kind you wash your hands with, becomes a thicket of tangled fibers. The long-standing mystery of how it removes dirt may be solved by study of such photos.

The best grades of face powder, and compositions used for delicate polishing operations, look like shrapnel.

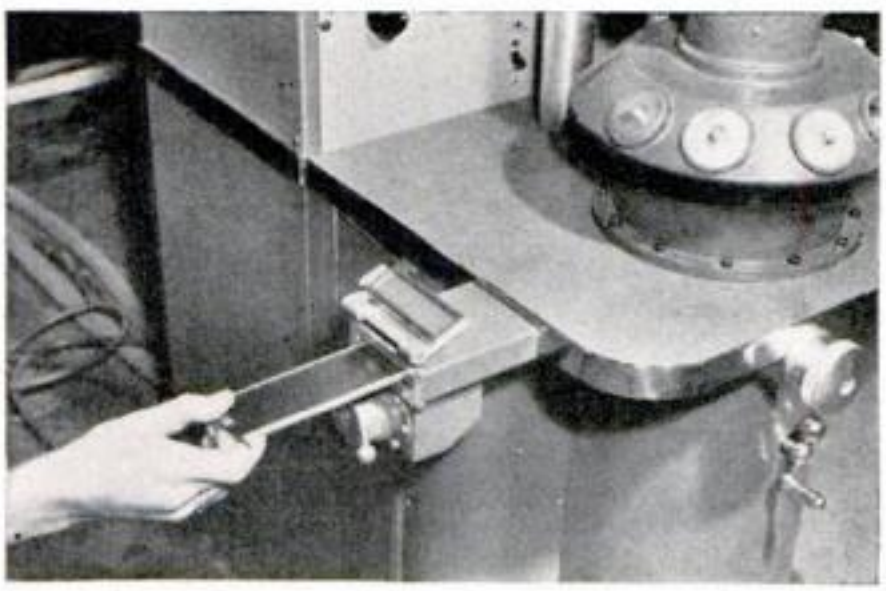
Impalpable smoke from burning magnesium, used in flares and incendiary bombs, forms beautiful cubical crystals.

Tiny dark specks, believed to be molecules, appear in filaments of synthetic rubber magnified 100,000 times.

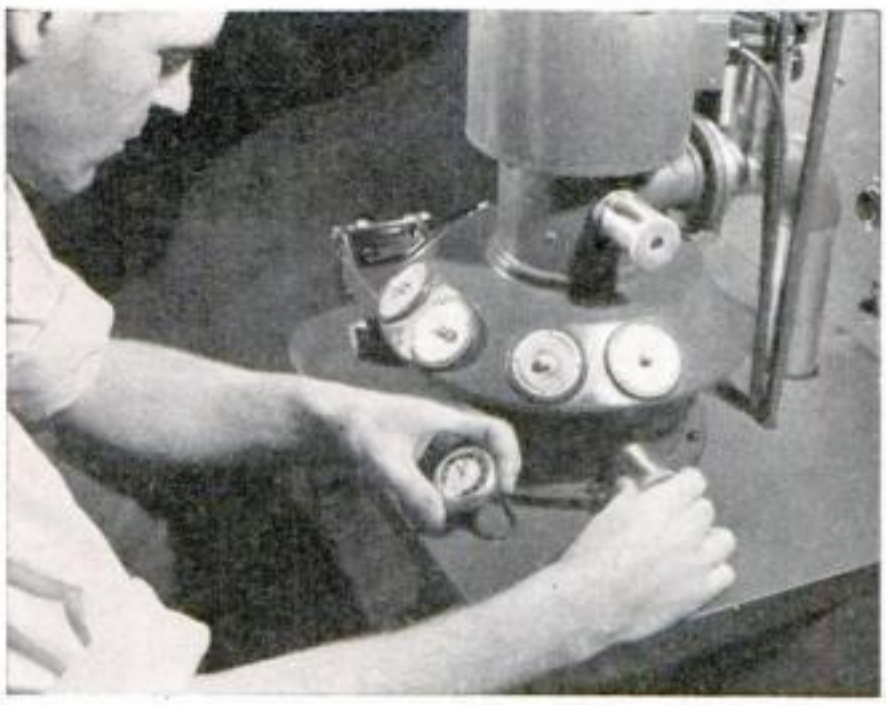
Views of disease germs, revealing details never before seen, may make bacteriologists begin their studies all over again. One kind has spiny "legs"—whether for locomotion or not awaits further research. Diphtheria germs have been seen to absorb a salt and transform it into pure tellurium—an example of the possibility of watching germs react to different chemicals. Viruses injected into rabbits have been seen attacked by antibodies.

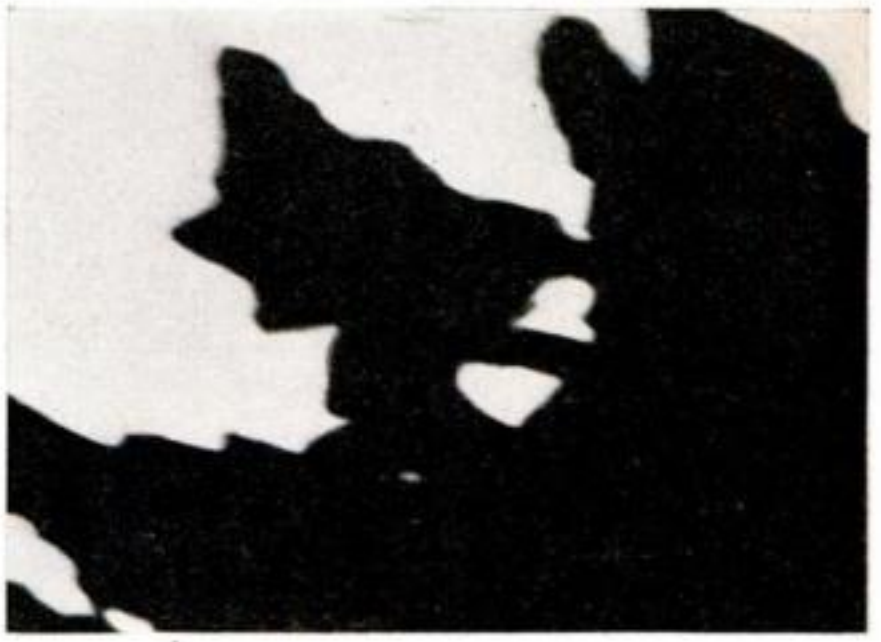
The compact new electron microscope, its power supply built in, is the outgrowth of experimental apparatus developed by RCA a year ago. At Camden, N. J., eighteen of the new $9,500 models are nearing completion. According to report, priority in delivery will go at Government request to laboratories which will use the superpower microscopes in national-defense work.

FACE POWDER looks like shrapnel at a magnification of 35,000 diameters. Below is commercial IRON OXIDE, used for the finest polishing operations, as it appears enlarged 15,000 times

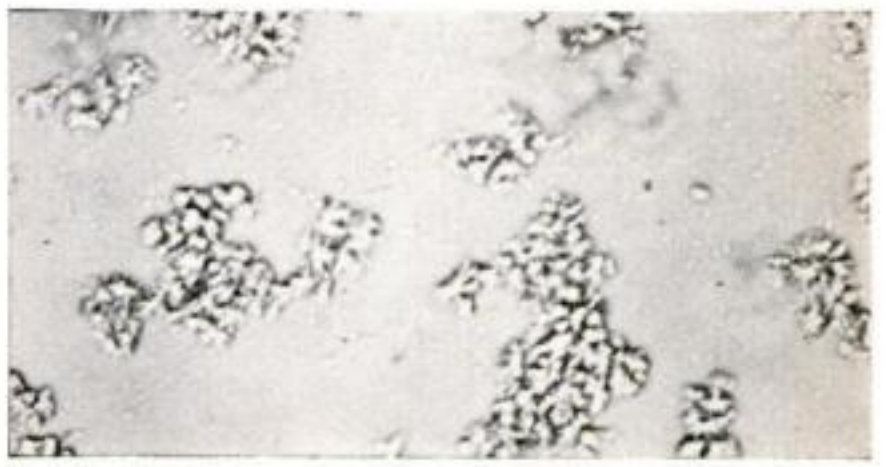


Incased in a holder, a 2 by 10-inch photographic plate goes into the microscope. Then the fluorescent screen is moved, as shown below, for an exposure





PRECIPITATED CHALK, magnified 36,000 times by the electron microscope. For comparison, below is the same material magnified 2,000 times by one of the finest microscopes made in the optical type



Mask Making

One of America's Oldest Arts

SINCE prehistoric times mask making has been an American art. The first American, like the Indians and Eskimos of recent times, carved huge, fearsome faces out of wood, and wore them in religious dances to frighten away evil and disease. Sometimes, however, entertainment may have been his goal, as it is of the modern mask maker like Remo Bufano, a short, lively Italian-American of New York's Greenwich Village, who is one of the foremost present-day mask sculptors. Bufano has created between 2,000 and 3,000 masks out of papier-mâché. He began as a boy in New York's "Little Italy," and devoted so much time to his hobby that neighbors often commented that his days might better be spent in looking for work. But by the time he reached manhood he had a city-wide reputation and his hobby became a profitable career that has made him famous throughout the country.

This wood mask was carved by an ancient American

Color Photos American Museum of Natural History

His masks have been used at New York's Metropolitan Opera House in a production

. . . as was the one at the left, while these nursery-rhyme characters are three of 60 created by Remo Bufano, modern exponent of the art, for the clowns in the Ringling Brothers and Barnum & Bailey Circus

1 In making a mask, Remo Bufano first models it in clay, following a sketch of his own or one supplied by the customer ordering it

2 The clay model is covered with plaster reenforced by burlap, to form a mold. Dried, this is taken off in sections and reassembled

3 Into the inner surface of the hollow mold Bufano presses strips of a special featherlight Japanese hand-made silk-fiber paper

4 Now the paste-soaked paper shell is removed from the plaster cast and shellacked. Nose holes and other openings are cut

5 Headbands go inside the paper shell, along with mechanical fixtures for effects such as moving jaws, usually worked by strings

6 Bufano believes in providing plenty of holes for ventilation. He covers them with strips of gauze painted to match the mask

7 A ground coat of white paint goes on as a priming before the final painting. Here Bufano examines the product, a wicked wolf

of the ancient Greek tragedy, "Oedipus Rex," and in various Broadway shows. This year the Ringling Brothers and Barnum & Bailey Circus features his masks in the parade of the clowns.

Bufano tailors his masks to fit individual wearers. For Eva Le Gallienne's production of "Alice in Wonderland" he made plaster life masks of the 40 performers so as to make sure that his three-dimensional copies

Horse masks covered with cloth. Their spots were applied with embroidery

This moon mask was a problem in engineering. A wire framework supports it, and the wearer steps into it like a pair of pants

of John Tenniel's famous drawings would fit snugly. Some of these were only pieces to be pasted onto the performer's faces, such as a set of jowls for the horse-faced Duchess.

Bufano has a great admiration for the ancient mask makers, particularly the Greeks. He points out that the trumpetlike lips of the ancient dramatic masks magnified the performers' voices, so that they could be heard in the vast amphitheaters, and that the stylized expressions suited the formal plays in which the situations and characters came from mythology.

Air Safety for Factories

AN ARCHITECT SURVEYS THE PROBLEM OF INDUSTRIAL BOMBING PROTECTION

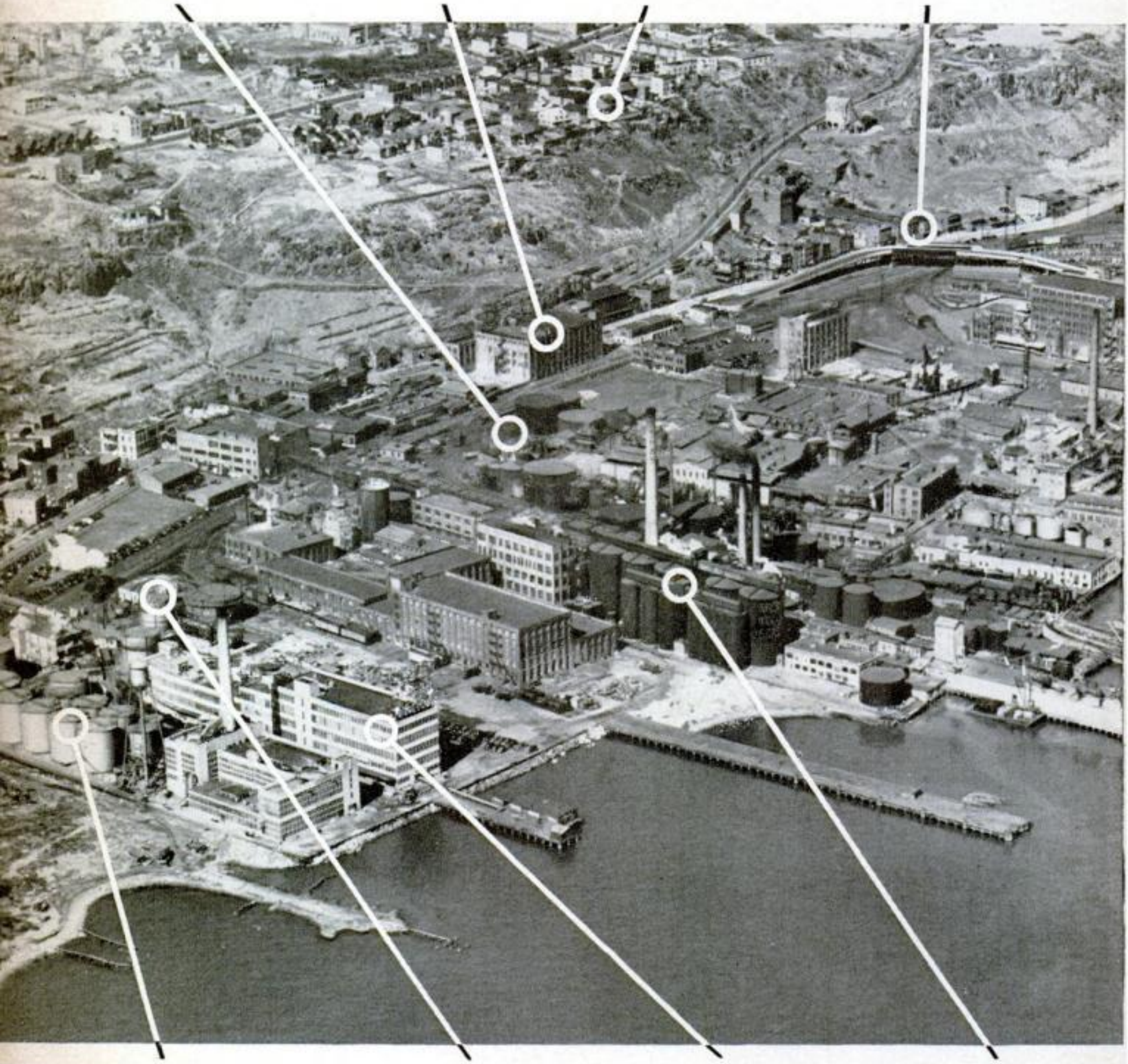
The author of this article, Konrad F. Wittmann, has had wide European experience in designing buildings for safety in air raids. Below, on an aerial photo of an American manufacturing area, he points out some typical danger signs

1 Tanks are too near the main-line railroad. A hit with a bomb could tie up through traffic by rail

2 This building is so placed that its collapse would block access to all plants

3 Residential area is properly placed far away from the plants and other military objectives

4 Here a stone bridge gives only access to the large plant at right. Too vulnerable!



9 These shining tanks are an invitation to bombing. As shown here, they are quite unprotected

10 Gas works supplying the whole area are in the one spot most likely to be hit hard in a raid

11 Windows reflect the light, and straight white lines tell their story to the bombardier

12 These tanks are too closely crowded together. A fire spreads rapidly in such a place

FACTORIES, like bananas, grow in bunches. As a result, most American industrial plants are a bomber's dream of a perfect target, so big and bright and shining he can hardly miss them. Best of all, in many instances a single bomb can isolate a huge bunch, by demolishing a bridge, crossroads, or railway junction. Collapse of one building, too, will often block traffic to several others, and so many power plants are built in danger zones that, with luck, he will be able to paralyze entire towns.

At present there is little time to move existing factories, but the danger can be minimized by constructing alternate entrances, roads, power plants, and sewers. This is more important than camouflage, as concealment can never be perfect. Factories and bridges, factories and railway junctions, are explosive neighbors. The vulnerability of their sewers has concerned Londoners more than the destruction of their homes.

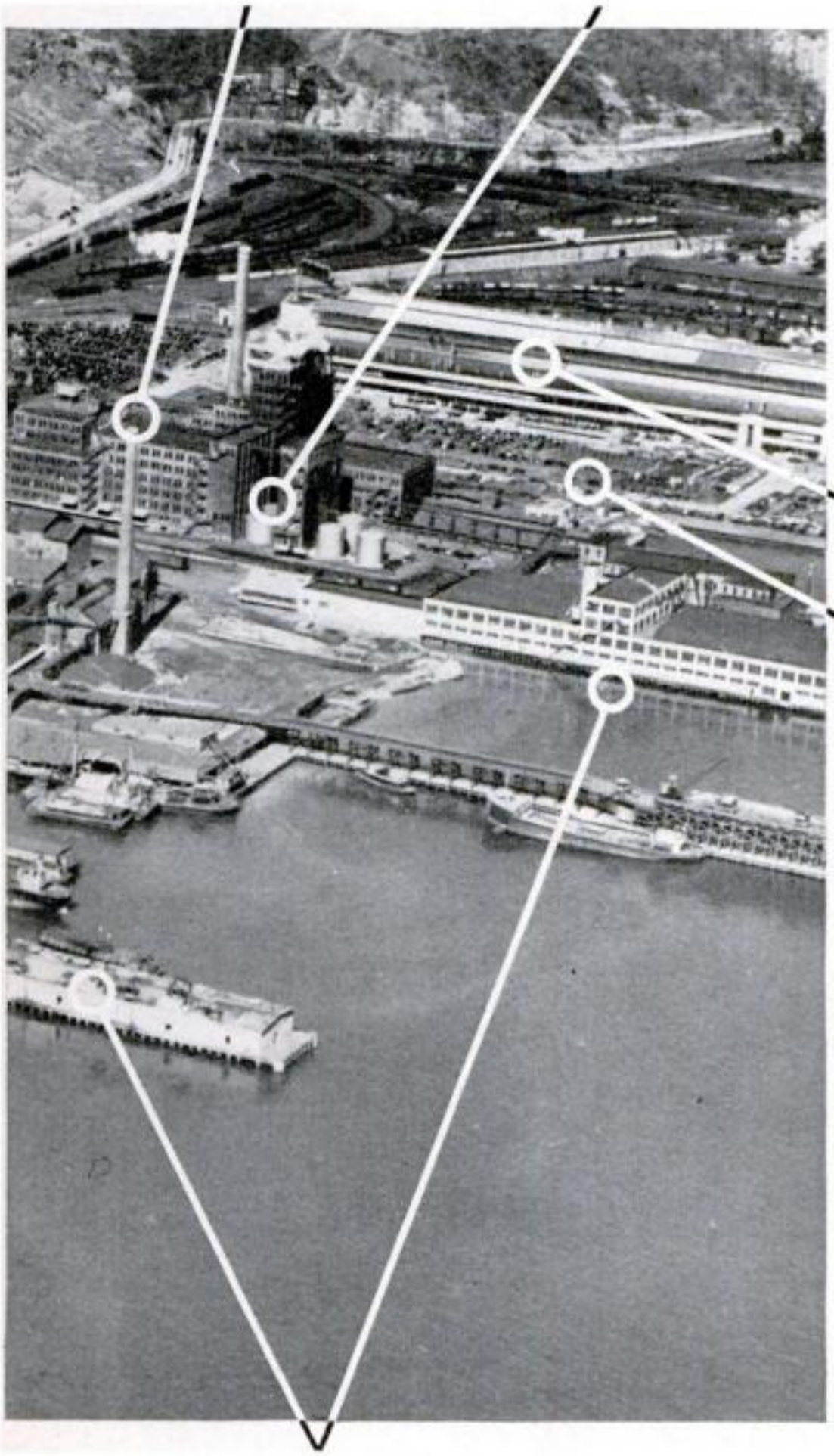
Because of topographic conditions, it is useless to try to hide some plants: a factory in a river bend is easily located, no matter how well it is camouflaged. Many, however, can be made confusing to the eye of the bombardier, and some of them even hidden from the almost X-ray vision of the aerial camera.

Painting fields and gardens on the roofs won't hide them, however, any more than the dazzle painting of the first World War, since the building will still cast long shadows. Seen from great heights, all colors run into one another to a smudgy green or gray, but shadows stand out clearly. Nature is always irregular, but the shadows cast by factories spell out an easy lesson in geometry which he who flies may grasp at a glance.

It is almost impossible to eliminate the shadows cast by buildings

5 Narrow courts between buildings are bad. An explosion here has a devastating effect

6 Here a glass-fronted building is too near a tank. Expanding gases would shatter the windows

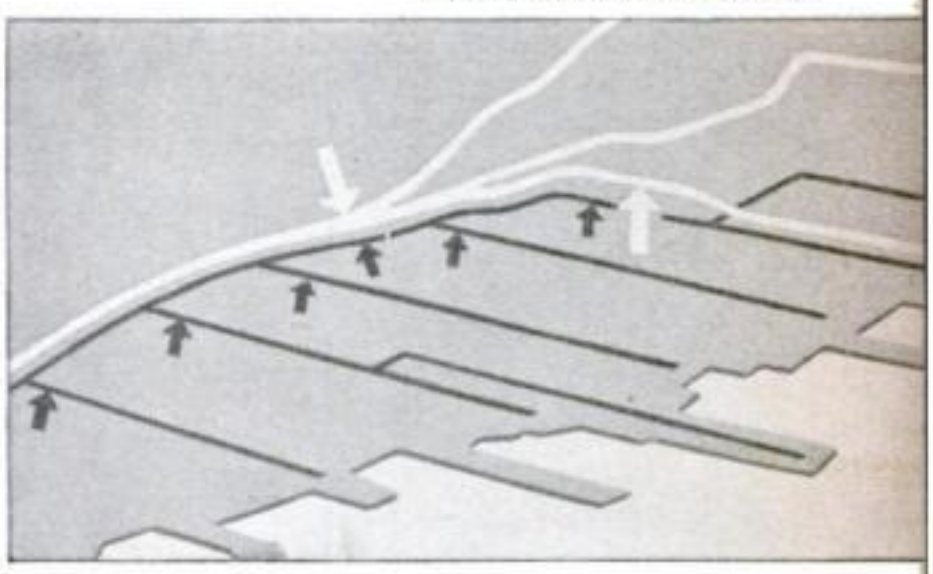


7 Very long roofs with light-reflecting surfaces are perfect signposts to guide enemy bombers to their targets

8 An uncamouflaged parking space, too, makes a white spot that is visible on the landscape for a great distance

13 White buildings on the piers are outlined against the dark water. By effective camouflage, they would be made to blend with background

McLaughlin Air Service Photo



Bottlenecks in the street system and supply lines. Arrows indicate spots where collapse of buildings would block traffic with debris, cutting off flow of materials and products

of several stories, but fortunately most factory buildings are fairly low. Snaky, cantilever roofs have been devised to break up their shadows, and make them look like a woodland, field, or a residential area.

Bright roofs and reflecting rows of windows signal to the bombardier even more loudly than shadows. Windows of sawtooth roofs, which reflect the sun's rays back into the air, are among the worst offenders.

The aim of camouflage is to make a building invisible by blending it in with the surrounding landscape. The pattern of the neighborhood thus determines the scheme. A factory tricked out to look like a field is no good if it is in the center of a residential district. Instead, the large masses and lines of the factory must be broken up into a checkerboard of small brown, red, gray, and green spots to simulate courtyards, houses, gardens, and trees.

Visibility, especially at great distances, is more a matter of reflections than of colors. Every one with any experience in photography knows that smooth surfaces appear much brighter than rough textures, that glossy surfaces reflect light and appear white, while dull surfaces of the same color absorb the light and look darker.

This is true to a large extent even to the eye of the bombardier, as he looks through a telescope or finder. It is doubly so to the aerial camera. Cameras which open automatically give strips of overlapping pictures having a three-dimensional effect when studied under the stereoscope. Special lenses, infra-red film, and color photography will usually brush aside the trickiest screens.

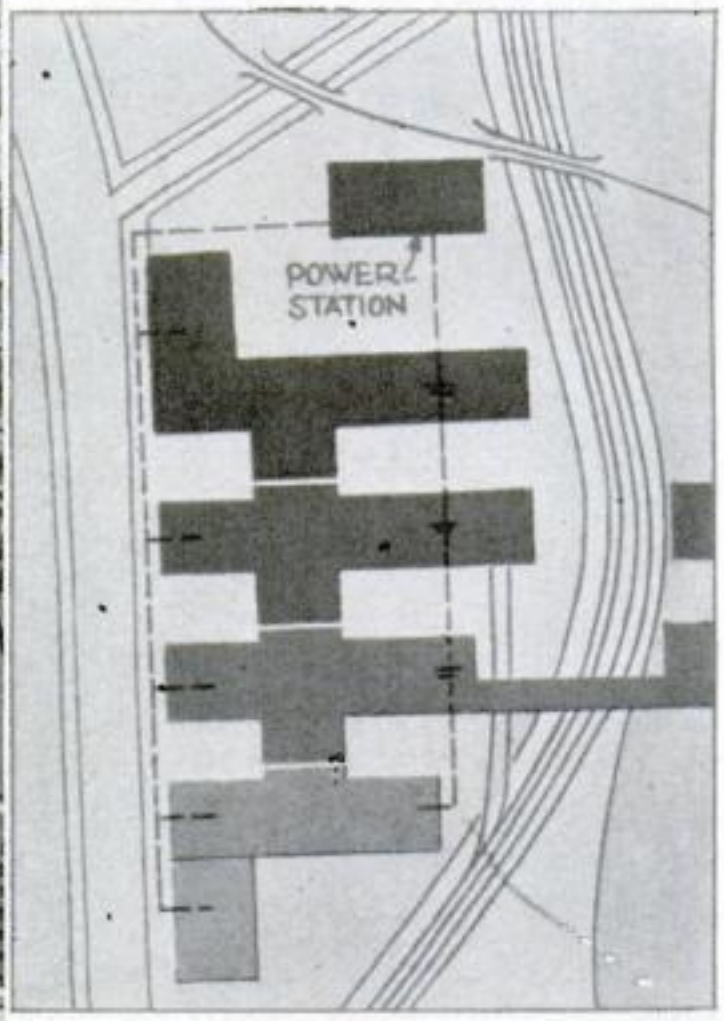
Where the neighborhood pattern permits, planting roofs with grass, shrubbery, and even trees is best. Trees around factories or in parking areas make it difficult to pick out a camouflaged building. Where roofs are painted, dark colors and flat paint are generally preferable.

Water reservoirs and storage tanks should be underground, or at least away from buildings. A water basin for emergency use can be shaped like a swimming pool. Hoods may be placed over storage tanks to eliminate shadows and, at the same time, protect them against splinters and light bullets. Embankments will prevent flooding and, in the case of chemicals, usually prevent the spread of fire.

Nearly all camouflage of existing fac-

At the left is a dangerous congestion of buildings. Easy to locate, it has narrow courts to increase violence of explosions. Power plant is vulnerable

Fairchild Aerial Surveys Photo



An improvement is shown in the layout above. Open courts dissipate force of explosions. Collapse of one building is not so serious. Power plant is isolated

tories is makeshift at best. They are too congested, too geometrical in pattern, and generally located too near other military objectives, such as railroads, highways, and docks. A great many of this country's key plants lie along the seaboard. New ones should be built far inland when possible.

Best is wooded country, far away from natural landmarks such as rivers, lakes, and hills casting characteristic shadows, as well as far from main highways and railroads. Transport may be more expensive, but that must be secondary to concealment. Plants should be broken up into a number of small ones, and the buildings of each factory kept small and scattered, with trees arching over the roads connecting the different buildings. Twenty small, low buildings, a quarter of a mile or so apart, are much easier to camouflage than one big one.

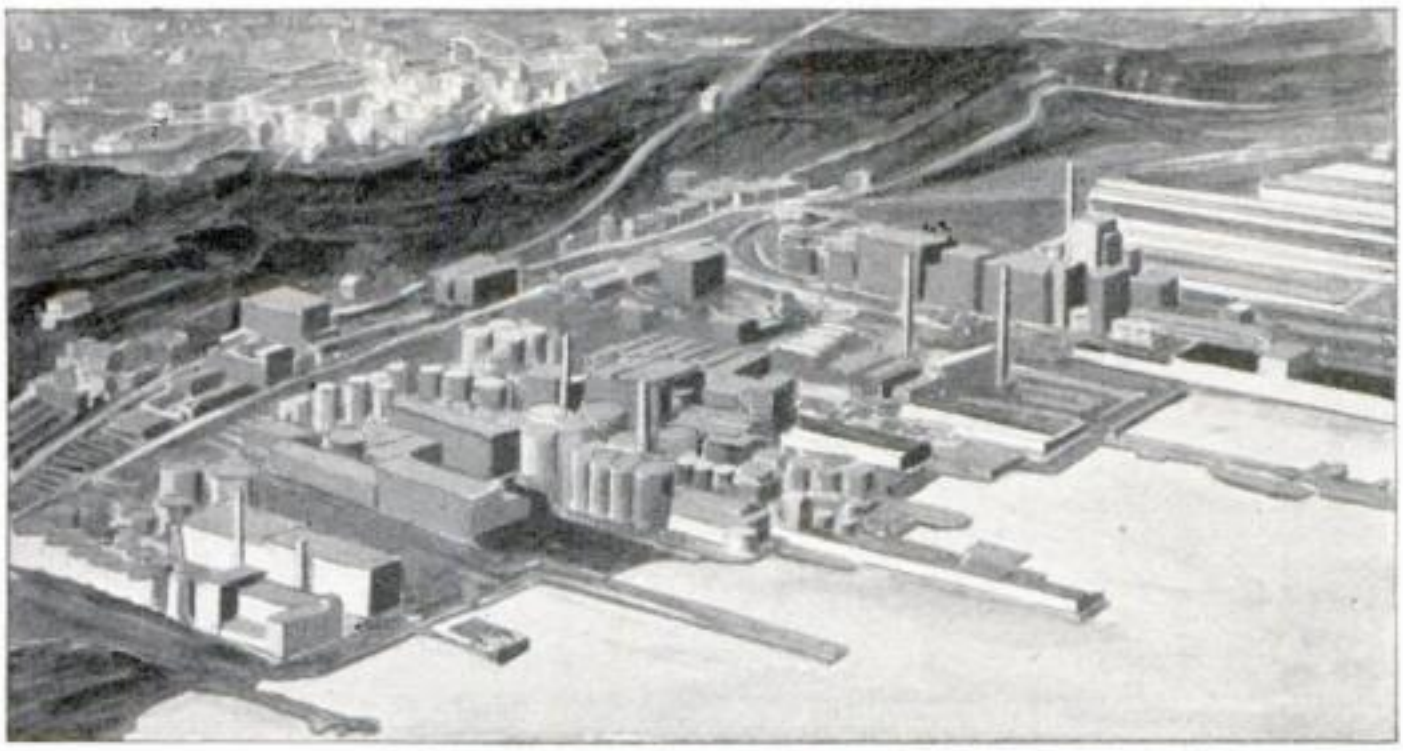
Underground factories are, of course, the safest, but a new type of plant, built recently in the United States, promises much. It is windowless and equipped with fluorescent lighting and zoned air conditioning. Proper light, temperature, and humidity can thus be provided at all times, no matter what the conditions outside, while bulkheads, similar to those in ships, will localize damage.

Absence of windows, however, while it makes camouflage easier, tends to multiply the effect of explosions. Study of explosions of many kinds shows that the more window panes are blown out the less damage is done to building and machinery by internal blasts.

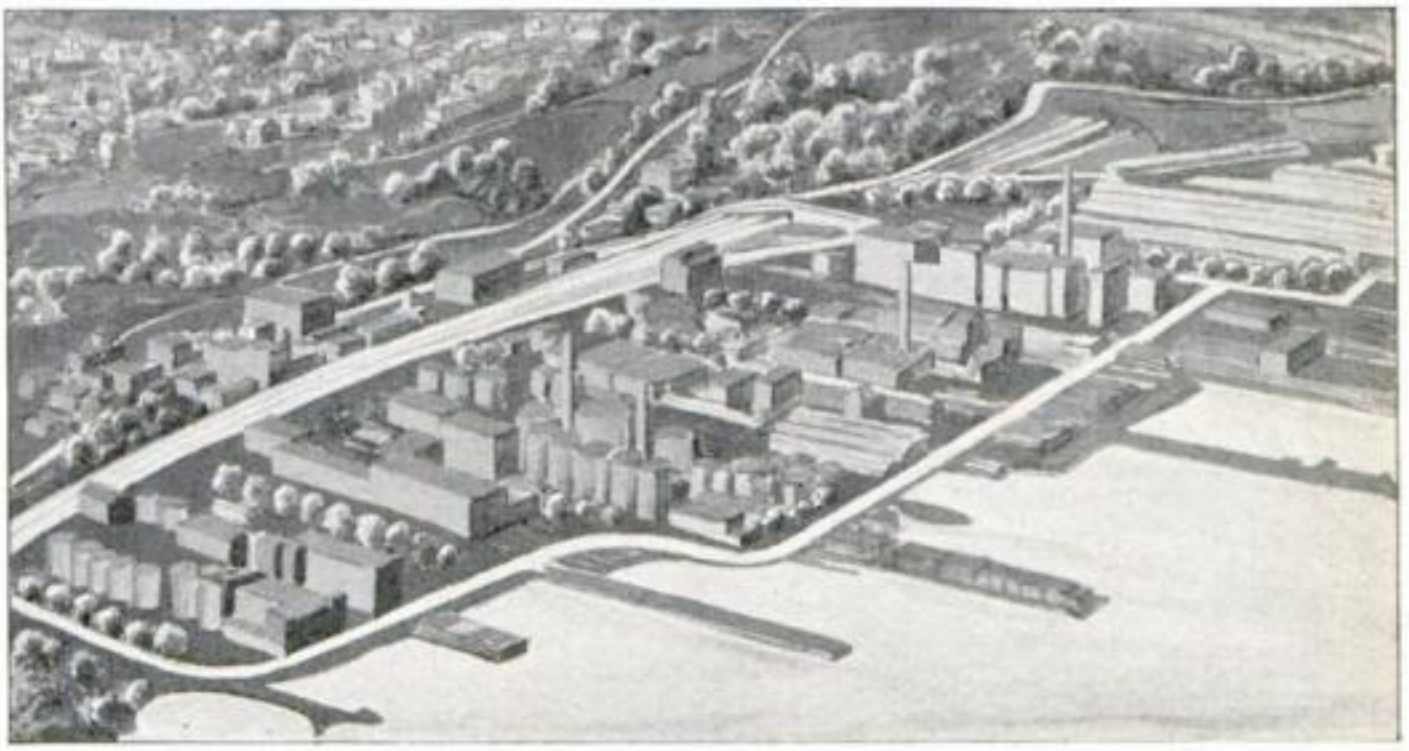
Similarly the risk of demolition is reduced by providing open space between buildings, when several must be grouped fairly close together. In theory, at least, round buildings would be the least vulnerable, because they offer the least resistance to air pressure. Square buildings are better than rectangular ones, and low ones much less vulnerable than structures of several stories.

Structural frames of steel or reënforced concrete are less likely to collapse than solid walls of brick. Such frames, with light curtain walls and big windows, therefore are better when buildings must be grouped. Material which will break into large pieces is preferable for both buildings and paving to bricks or other material which will disintegrate into small bits, for such small bits will often damage machinery more than shell fragments.

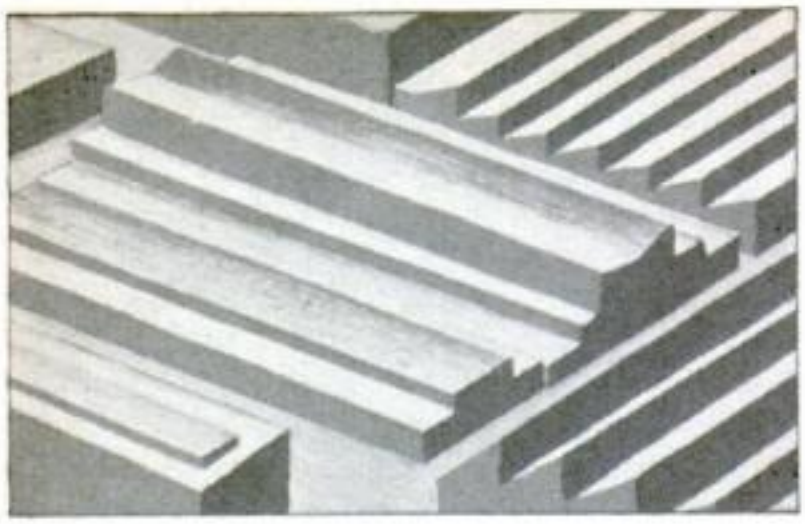
Roofs as well as walls and windows can



In this view of the area shown on pages 48 and 49, contrast of a shadowed hill, bright waterfront, and lines of light-reflecting walls is a guide to bombers

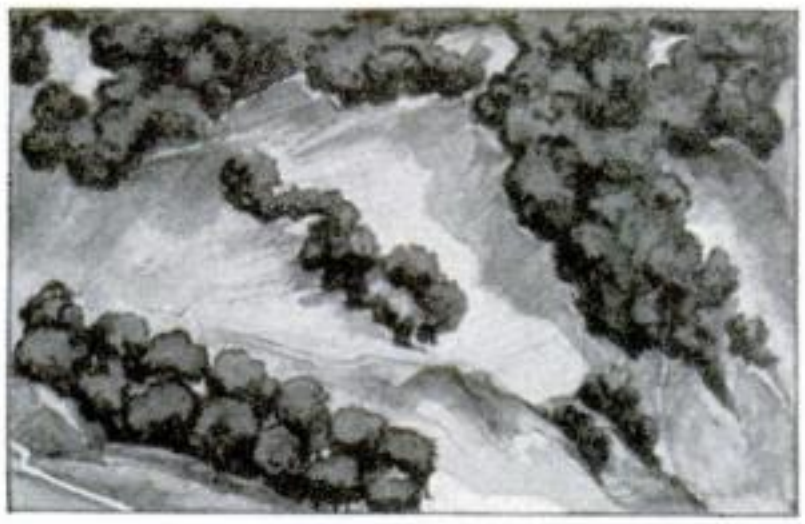


By changes indicated here, visibility is lowered and the danger of direct hits is reduced. The byroad along the waterfront gives an additional artery for supplies

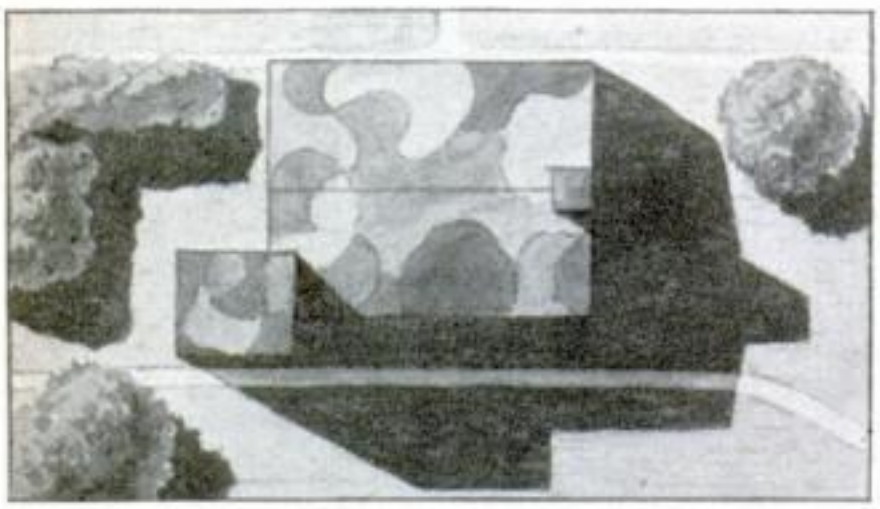


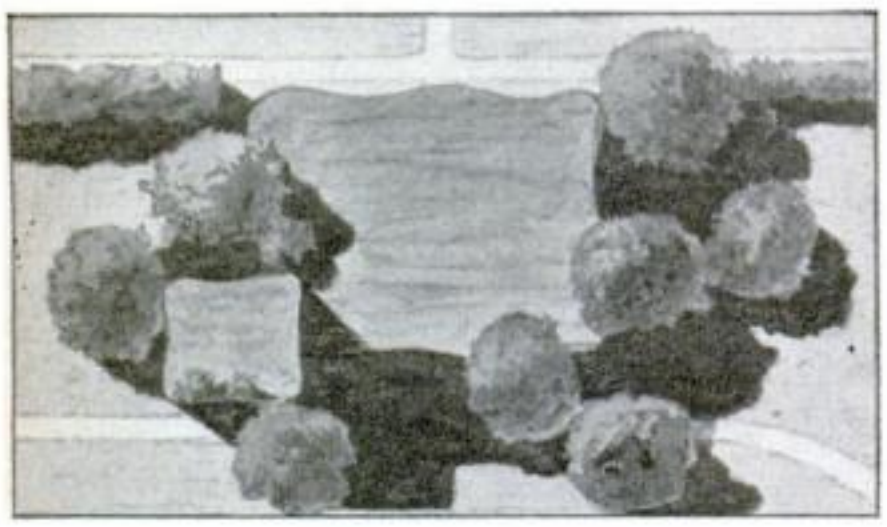
Long, regular factory buildings are hard to blend with their surroundings. They have characteristic shapes that betray them . . .

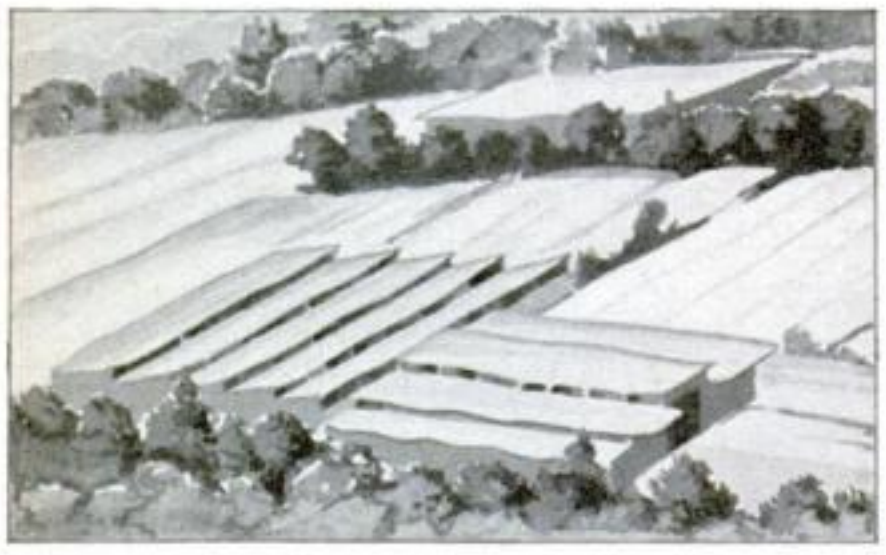
. . . while residential areas create a checkered pattern of irregular squares. This can be imitated in planning factory districts



Nature is always irregular. Any regularity, such as the straight row of trees, shows man's hand. A wooded area is best for factories







provide safety valves. It is often better for a roof to be blown off easily than it is for it to confine an explosion, with consequent greater damage to machinery and the frame of the building.

Just as the invention of firearms led to the razing of the walls of medieval towns, and resulted in expansion of cities and towns, so the need to protect buildings from bombings must of necessity revolutionize factory design and even result in the use of new materials.

Esthetically the changes in factory design enforced by the need for protection against enemy aircraft can hardly be for the worse. Overcrowded industrial areas have long been ugly and unhygienic. Decentralization should certainly provide cleaner and more healthful working and living conditions, while blending factories into the landscape is bound to improve their appearance.

As shown in the upper illustration, the old-style "dazzle" camouflage painting is no good for factory roofs. Shadows reveal the shape and height of buildings

Roofs of serpentine outline, planted in grass and surrounded by trees, blend into rural surroundings. This trick is effective only on low buildings, however

For farming country, low, flat-roofed buildings fit into the patchwork pattern of the cultivated fields. This device is illustrated in the drawing at the left

Cafe Owner Uses Coal-Shed "Studio" To Operate His Homemade Juke Box

Operator announces numbers in radio style and dedicates some to regular patrons. Sound effects yield comedy

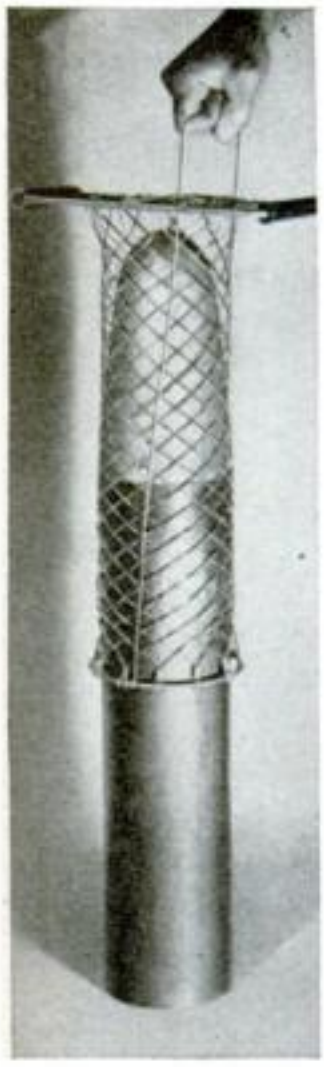
PUTTING two of his hobbies to work, the proprietor of the Hotel de Hamburg in Paw Paw, Mich., now provides his customers with free music of their own choice while they eat. One hobby, tinkering with radio equipment, enabled him to convert a coal shed into a "broadcasting studio," equipped with two electric phonographs and a microphone which were hooked up to loudspeakers in the restaurant. The second hobby, collecting phonograph records, had provided him with a library of 3,000 selections, ranging from classical music to the latest swing. A list of the records, posted on a wall of the restaurant, with a second microphone beside it hooked up to a speaker in the studio, permits the customers to tell the operator of the phonographs what they would like to hear.

Customers have 3,000 selections to choose from and enjoy requesting their favorite songs over a microphone hooked to a speaker in the studio

"Centering Microscope" Spots Drill Point Within .00018 Inch

LOCATING a drill point within .00018 inch of a desired point is said to be possible with a "centering microscope" developed by Stanley Griffin, of Glendale, Calif. The instrument is fastened in the chuck of the drill press with which the hole is to be made, and a 70-power lens system then throws an image of the work to be drilled on a leaded prism within the microscope. When the marked point where the drill is to be centered appears in the center of a square formed by two sets of parallel lines .004 inch apart, the operator knows the work is properly placed. Then the microscope is removed and replaced with the drill, and unless something slips, the finished hole is right where it belongs. Aircraft and automobile manufacturers are said to be testing the device.

INDUSTRY REVIVES AN OLD PUZZLE



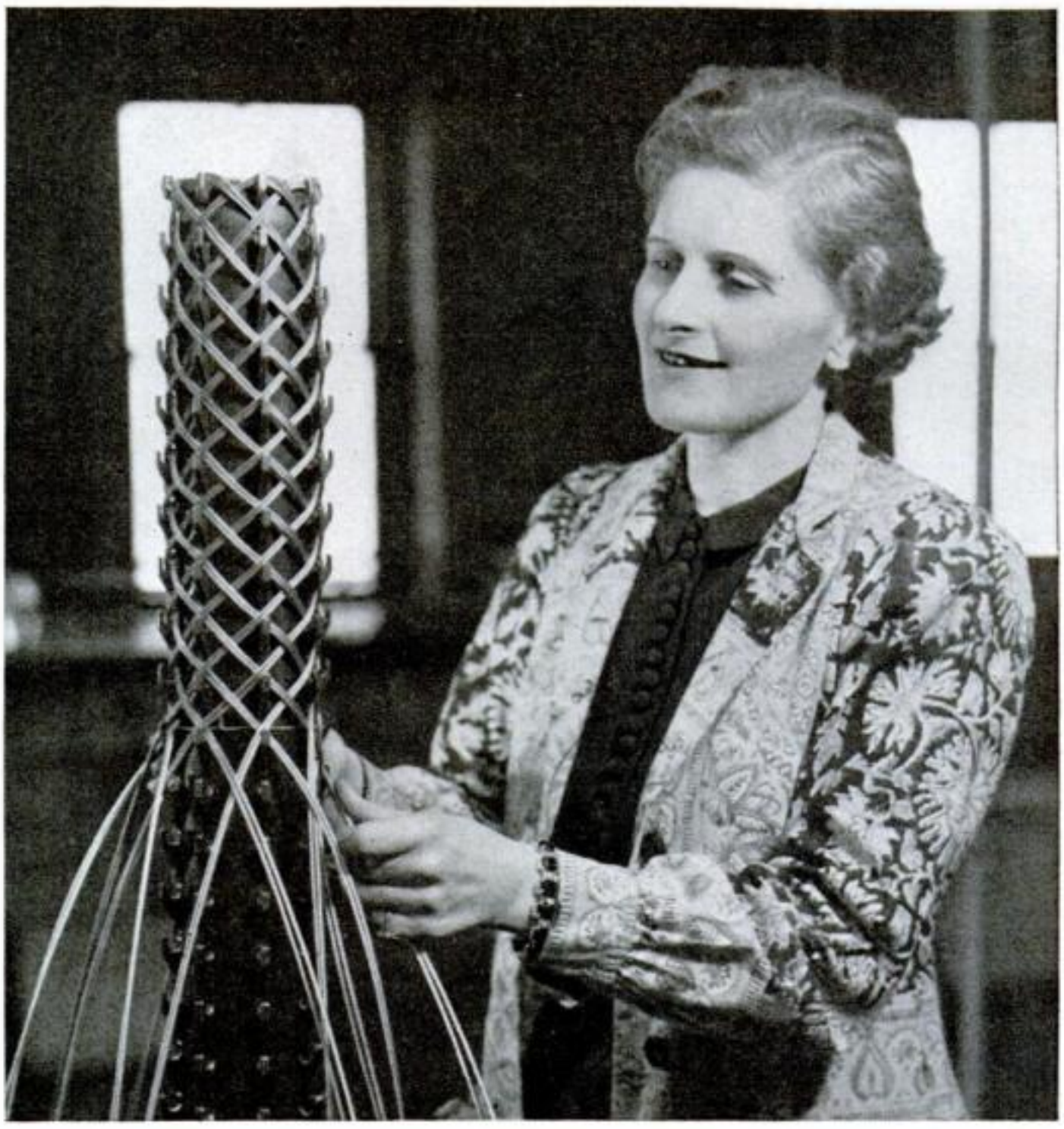
Releasing a shell gripped by the lift patterned after an ancient Chinese novelty. Raising the release bar relaxes the wire mesh

In the lower photograph, a projectile is suspended in a lift of another type. It cannot slip out unless the release bar is raised

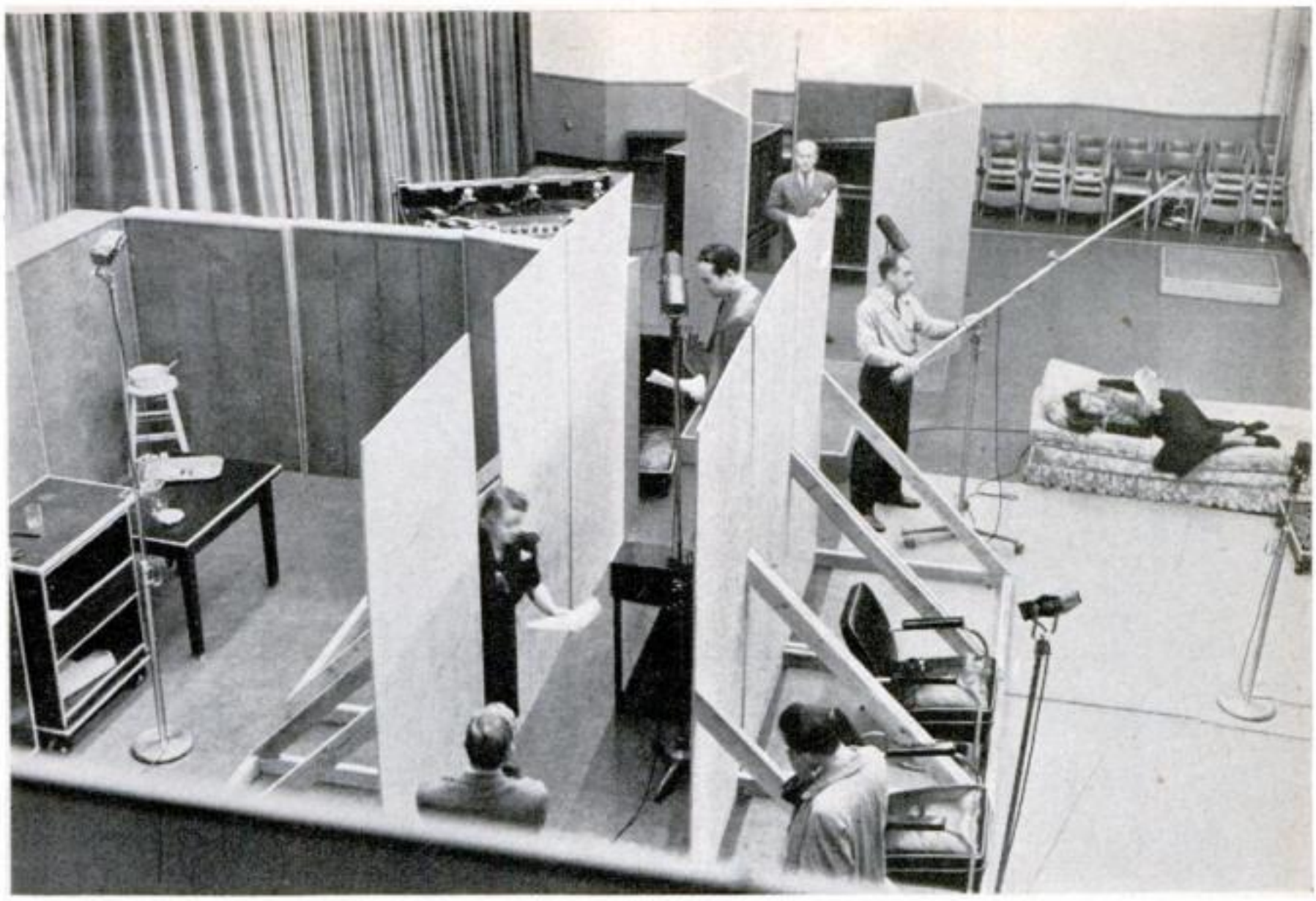
IN A centuries-old Chinese novelty, Vivien Kellems of New York City has found a new way to handle war projectiles, and to perform a host of useful engineering tasks.

The original Oriental puzzle, a tubular sheath of braided straw, traps a finger thrust into it. The harder you pull, the tighter it grips. Countless generations have enjoyed the mystifying toy, but it remained for Miss Kellems—now Kellems Products, Inc.—to devise practical applications for it. Strong wire, instead of straw, now serves as the raw material.

For moving artillery shells, one model employs a woven cage with a pair of handles. When these are raised, the wire webbing tightens on the shell. It cannot possibly slip loose until the shell is set down, and a release bar is raised, easing together the ends of the flexible cage. A similar device serves with a power hoist. Others drag cables through conduits, lift telegraph poles, temporarily support elevator cables for splicing, and uproot wooden piling.



Vivien Kellems, who put the old Chinese trick to work for industry and defense, braiding a larger grip for use in lifting poles and cables, and for similar jobs



Seven microphones pick up the radio actors' talk as they move from room to room of this movielike set

Radio Sounds Go Three-Dimensional

BY USING skeleton bungalows, submarine tunnels, oversize metronomes, cores from paper rolls, and movie-like sets, radio engineers have developed ways to broadcast "sound in depth," with three-dimensional effect. In the past, listeners have usually heard a series of close-ups. N.B.C. engineers and actors rehearsed scenes from "Latitude Zero" in a submarine at San Diego, then the engineers built a tunnel of sheet steel wide enough for four persons to walk abreast, and 12 feet long. One end was open, and a two-way microphone hung at the other in front of an empty oil drum.

Players perform inside a steel tunnel simulating a submarine, some turned away from the mike

The interior of an air lock is suggested by talking through a hole in this large box

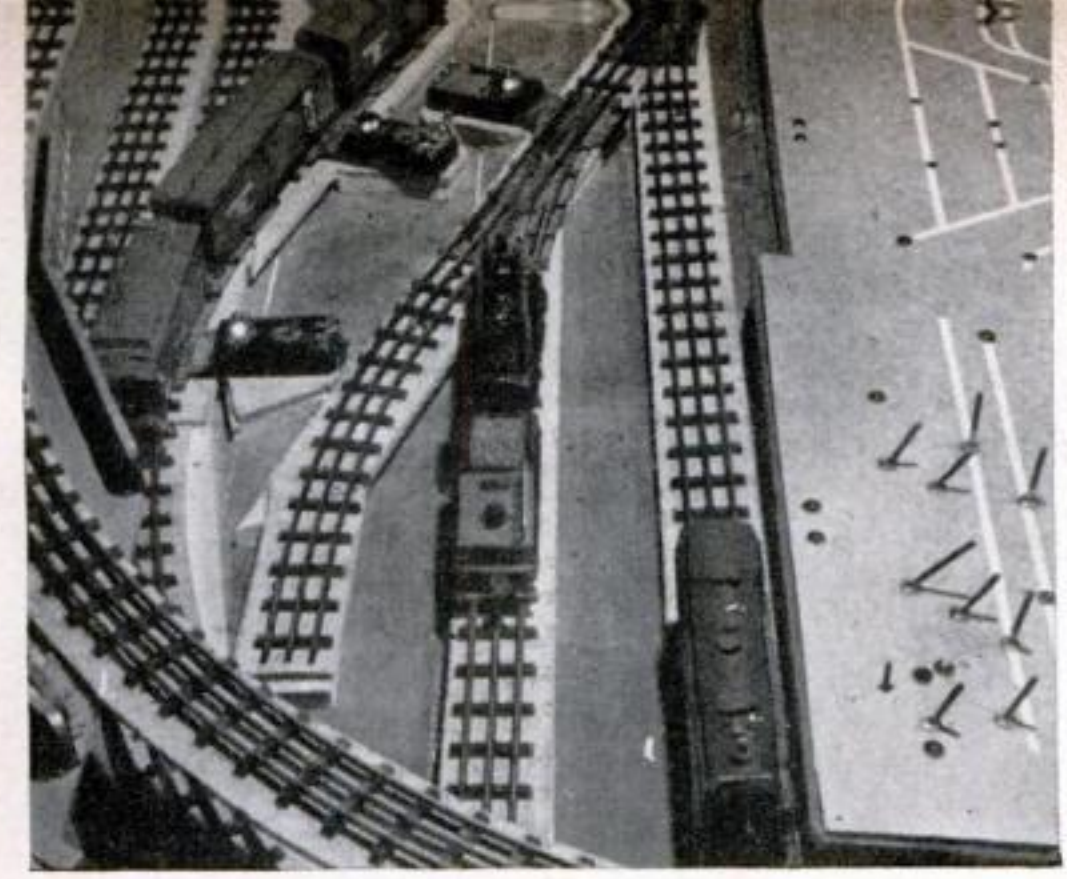
As octopuses attack the submarine, a sound man switches the roof with small branches

"Frany" Shinn, an old-time train fan, always handles two of the boards controlling the mile of track

TRAINS FOR GROWN-UPS

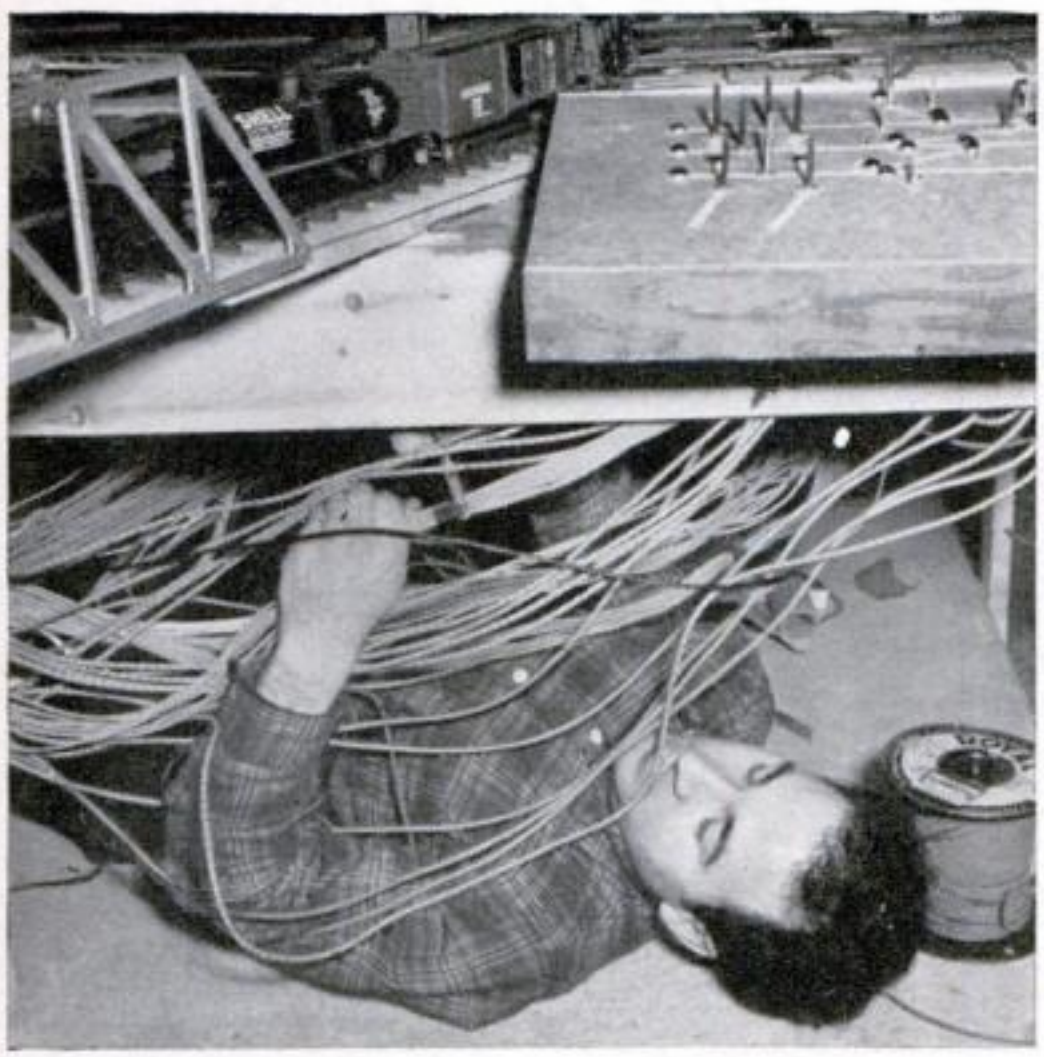
BILL ROULSTONE, Ted Mix, and Tony Ellis liked to build and play with trains when they were kids together, and they never outgrew their joy of it. Recently they decided to commercialize their hobby, built a mile of track in a New York City greenhouse, and made it available to the public. **Subscribers join for a season, and are assigned three hours a week, at their convenience, in which they, with 20 or 30 other train enthusiasts, can operate the 150 switches, five working bridges, 32 engines, and hundreds of cars. Thirty people are required to run the system. There are several large general dispatch boards and 26 small-town boards. Signals are sent out from the general board to each town, and also from town to town.**

Growing scenery is planned in this greenhouse background of tracks and bridges, to make it seem like the real thing



Part of the freight yard where the 32 engines and hundreds of cars are stored when the enthusiasts are not in session

Ogden E. Bowman, NBC radio engineer (left), and his wife relax by dispatching trains



Cars, engines, and boards often have to be repaired after the fans end one of their exciting sessions of railroading

Frances Freeman crawls from town to town; the floor line warns her not to stand up

Men and women of all ages get a real kick out of receiving signals and switching to avoid wrecks

Igor Sikorsky at the controls of his successful helicopter. On the opposite page, enlargements from a 16-mm. movie film show a stunt by which he demonstrates the remarkable maneuverability of the strange craft —delivering a parcel to a man on the ground without landing

Back to the Helicopter

How a Great Airplane Designer Made a Boyhood Dream Come True

BY HICKMAN POWELL

EVERYBODY has in his past some defeat, failure, or disappointment which he longs to go back and conquer. Back in 1908, when Igor I. Sikorsky was a 19-year-old boy in Russia, he built a helicopter which would not fly.

This is the story of how the man who first dreamed a practical dream of great ocean liners of the air, and made it come true, today is turning another vision into reality—this time the dream of back-yard aviation for everybody. For today Sikorsky flies a helicopter.

After his first failure, Sikorsky became one of the world's greatest airplane designers. But for 30 years every time he looked at a gnat, a mosquito, or a humming bird, he thought of that first bitter youthful failure—the helicopter which merely hopped off the ground and wobbled crazily sidewise.

He was one of those who had taught man to soar like an eagle and to swoop like a swallow. But the gnat had him licked.

A gnat could remain poised at one point in the air. It could rise and descend vertically, fly forward, backward, and sidewise. It could land on any spot, no matter how rough. And that kind of flying, of course, was what might be expected from a helicopter, a flying machine whose lift and motive power come entirely from vertical-lift propellers.

For 30 years, while building great silver

While Sikorsky maneuvers his mechanical insect . . .

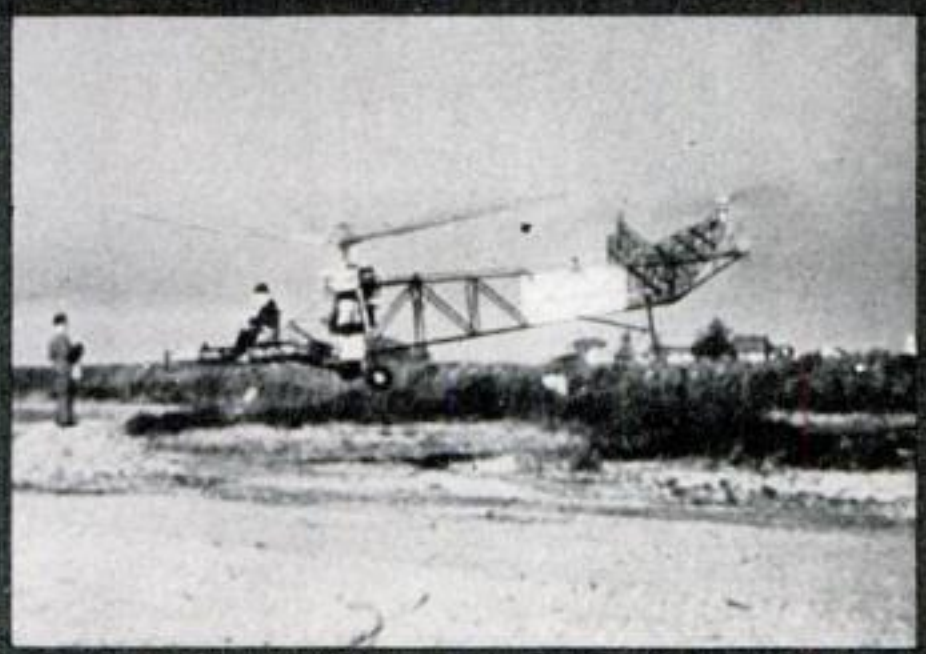
an assistant climbs up onto a small mound of earth

Reaching out his hand to the hovering helicopter . . .

the man on the ground lifts out a small handbag

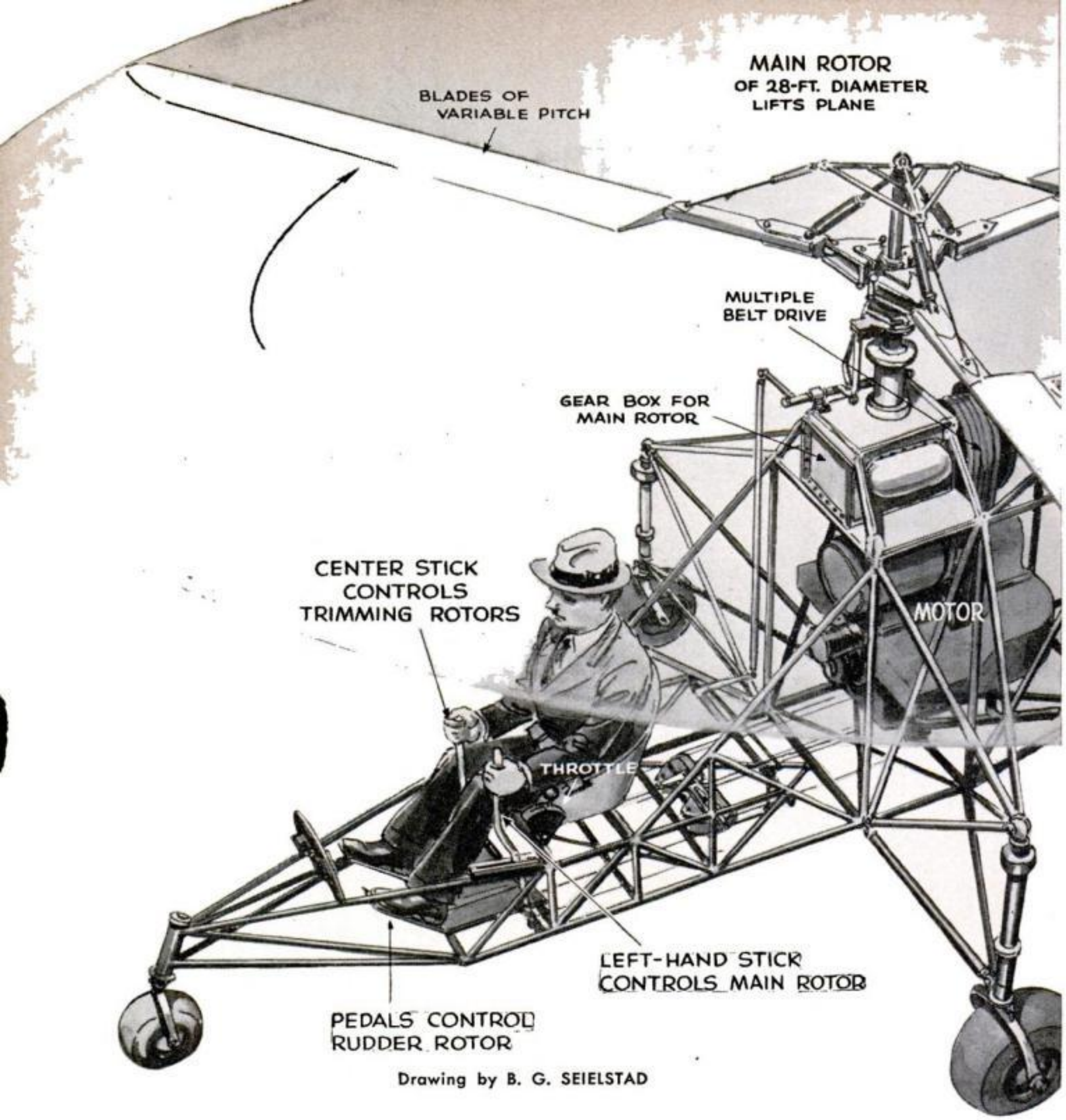
The craft backs away like a bee leaving a flower

It rises higher into the air, as if to fly away . . .



then noses down again to the man on the mound . . .

who returns the bag to its place at Sikorsky's feet

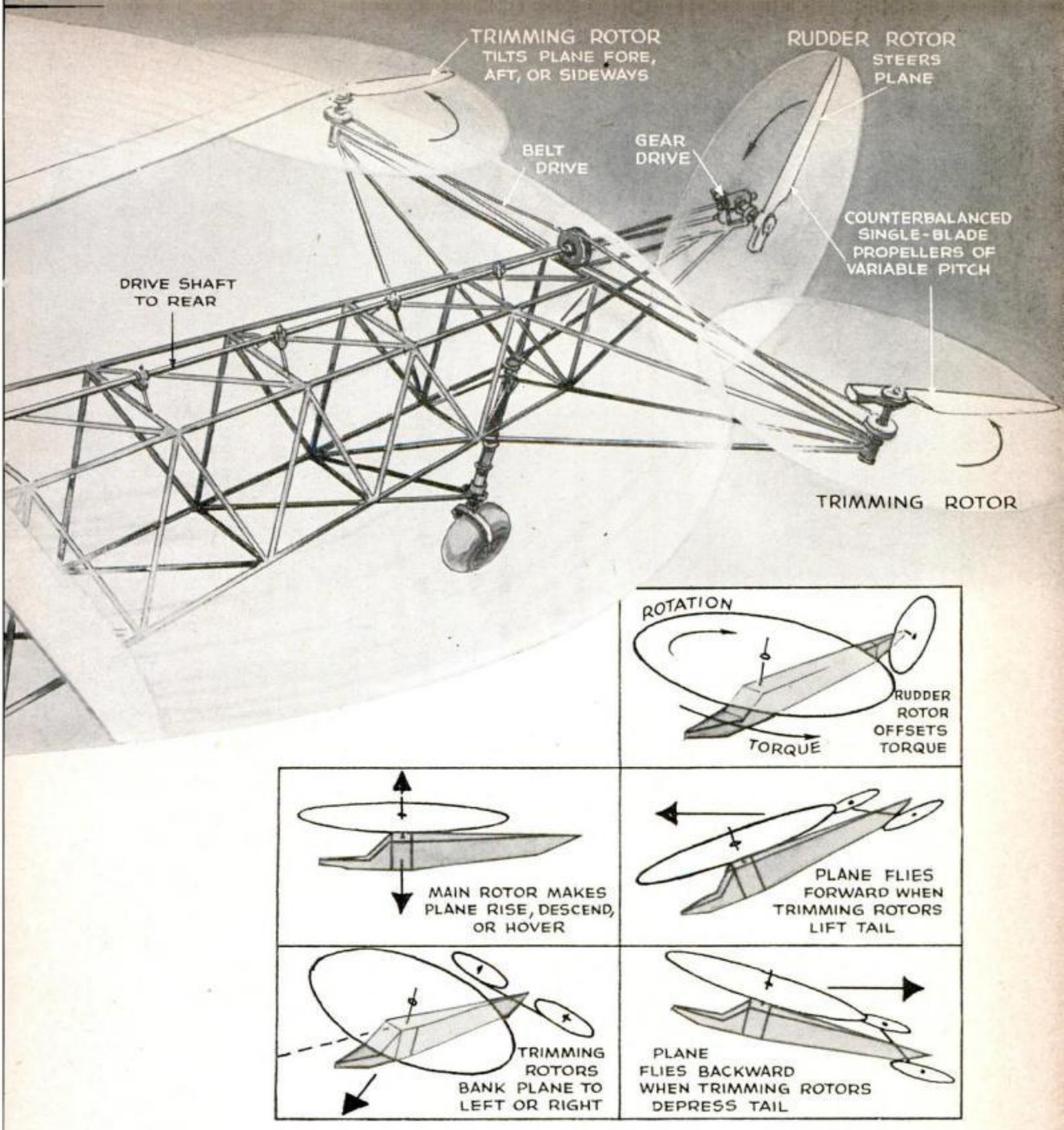


Drawing by B. G. SEIELSTAD

airships, Sikorsky puzzled over the problems of the helicopter. And today, while other airmen make every effort to build four-engine bombers, Sikorsky is again blazing a new trail—flying like a gnat.

Sikorsky's mechanical insect is a simple open framework of welded metal tubing. Its wings are merely the three blades of a great fan whirling horizontally above it, 28 feet in diameter. Its stabilizers, rudders, and ailerons are three 7½-foot rotors ranged across the tail. It bears a striking resemblance to the early boxes of the Wright brothers, especially with Sikorsky sitting at the controls far up in the nose, wearing a sedate business suit and a fedora hat, a bit small for him, perched high on the top of his head.

Workmen at the Vought-Sikorsky aircraft plant at Stratford, Conn., near Bridgeport, were at first thrown into consternation at the sight of the strange bug landing and taking off from among their cars in the factory parking lot. Now they take it for granted, with Sikorsky, that the helicopter is here to stay. But to most of us it would still be amazing to see this flying skeleton, the VS-300, come bobbing into a small fenced garden plot, descend and pick up a sack of potatoes from the gardener,



back off like a bee coming out of a flower, and then speed away at 50 miles an hour without even touching the ground.

On April 15, 1941, Sikorsky's VS-300A helicopter established an American duration record for aircraft of this class. The first officially recorded helicopter flight in the Western Hemisphere, it lasted one hour, five minutes, and 14.5 seconds.

Sikorsky sees the helicopter as the natural supplement of the great expansion of commercial aviation which seems inevitable after the present war. While airplanes more and more assume the function of long-haul transportation, the helicopter, able to land in small space, will take over the short hops —from airport to city, from city to suburbs.

The military possibilities of the helicopter are obvious. For instance, it could move with a motorized column, maintaining continuous observation. Officers and messengers could be hopped at will, here and there on a field of battle.

While fairly successful helicopters have been developed in Germany and France, Sikorsky's operates on new principles. It is the first successful helicopter in America.

Sikorsky's is the first helicopter anywhere which operates with a single main rotor.

The torque, or twist, of such a great fan is tremendous; and, to neutralize it, previous models have had two rotors whirling in opposite directions. In the German ship these are set to the right and left of the body, necessitating the transmission of power through long, heavy shafts. The French ship has the two rotors on a single axis, but this requires the operation of one shaft inside the other.

In the American machine the 28-foot main rotor, consuming 90 percent of the power, is mounted right above the engine. The remaining power is transmitted through a light shaft to the tail, to run the three 7½-foot rotors.

With the main rotor whirling to the right, the ship tends to spin to the left. But

mounted in the center of the tail, whirling in a vertical plane so that its power counteracts this spin, is one of the three small rotors. The operator's rudder pedals control the pitch of the blades of this vertical rotor, to vary its pull. When this pull balances with the main rotor's torque, the ship faces ahead. By changing the pitch of the rudder rotor, the ship is turned to right or left.

Mounted on either side of this rudder rotor are the two other fans, of equal size, whirling in a horizontal plane. The pitch of these rotors is controlled by the pilot's stick. Pushing the stick forward increases the pitch of both and lifts the tail, whereupon the main rotor pulls the ship rapidly forward. A backward pull on the stick reduces their pitch; thereupon the tail drops and the ship flies backward. Moving the stick to right or left changes the pitch of these two rotors differentially (increasing the pitch of one as that of the other is decreased) and makes the ship fly in the direction in which the stick is moved.

The movement of the ship up and down—that is, the power exerted by the main rotor—is controlled by a lever in the pilot's left hand. A pull on this lever increases the pitch of the rotor and simultaneously opens the throttle to provide the increased power to keep the rotor revolving at a constant speed of approximately 270 revolutions per minute. Power also may be controlled independently by a separate throttle.

These means of control, all based on the variable-pitch propeller, are Sikorsky's contribution to the helicopter. He is proud that his system of levers makes the pilot's reactions identical with those of the pilot of a conventional airplane. The use of the levers to counteract wind and other forces, Sikorsky finds, becomes automatic.

The interaction of these various rotors provides positive control for the helicopter even when it is hovering motionless. An airplane, like a boat, depends on its headway to make its rudder controls effective. But the helicopter is always under control, because its rotors are always moving faster than their individual stalling speeds.

If the helicopter's engine stalls in flight, the main rotor "free-wheels" and continues to turn because of the action of the air upon it as the ship settles or glides gently downward. It thus becomes an autogiro, sup-

ported by its rotating wing. It can land slowly at a forward speed of considerably less than 20 miles an hour.

If Igor Sikorsky's helicopter fulfills its promise, it will be a fitting climax to a life which has been almost as romantic as the story of the airplane itself. He was born May 25, 1889, at Kiev, Russia, son of a professor of psychology. His mother, who had studied medicine before her marriage, was a great admirer of Leonardo da Vinci. Her stories of Leonardo's designs for a flying machine created in her young son a great ambition to fly.

Sikorsky went three years to the naval academy at St. Petersburg. During the revolutionary troubles of 1905 he was sent to Paris to study engineering. Then he home to help build the S-5, which flew successfully. Less than two years after Sikorsky built his first airplane, his S-7 won an imperial prize of 30,000 rubles, and he was established as an airplane builder.

From the first he envisaged large planes. In 1913 he built his first big one, a 4½-ton ship with a wing spread of 92 feet. Its four engines had only 100 horsepower apiece, but the plane had a washroom, a clothes closet, a sofa, and a table at which passengers were served a hot meal in flight. With the outbreak of the World War it became the basis for the first four-engine bombers, of which Sikorsky built 75 for the Czar. Only one of them was shot down in 400 flights. They even had machine guns in their tails.

The Russian revolution wiped out Sikor-

A 32-year-old dream comes true: On the opposite page, Sikorsky is seen making his first successful helicopter flight above the Vought-Sikorsky field at Stratford, Conn. This was on May 20, 1940

Sikorsky built the great clipper planes that blazed sky trails across the seas. At left, he is seen with Capt. Boris Sergievsky in an amphibian which broke two world's altitude records for craft of its class

continued his studies at the Polytechnic Institute at Kiev.

The Wright brothers had first flown in 1903; but Europe had not yet heard of it. The internal-combustion engine had made flight possible; it was the bicycle, according to Sikorsky, which made it practical, by teaching men to make lightweight machinery. Everywhere men were trying to fly.

After Sikorsky's first helicopter failed, the young inventor salvaged his 25-horsepower engine and built another. That also failed. By this time Sikorsky had heard of the Wrights, and he switched to airplanes.

His first airplane, the S-3, still with 25 horsepower, stayed up a few seconds. His second cracked up after eight minutes in the air. Sikorsky's father mortgaged his

sky's world. He arrived in the United States in 1919, thirty years old, a penniless refugee. He landed a $12,000 job as an aircraft engineer, but the company promptly went broke. For the next few years Sikorsky earned a precarious living by lecturing on astronomy, in Russian. Meanwhile he worked on the plans of one of the greatest airplanes a man had ever dared dream of.

In 1922, with a few hundred dollars capital, Sikorsky started to build the S-29 in a barn at Hempstead, Long Island. His first six workmen were old classmates from the Russian naval academy, and they were augmented by a motley collection of princes and counts from the Russian refugee colony. Theoretically the Sikorsky Aero Engineering Corporation paid wages ranging from $15 for a mechanic *(Continued on page 212)*

MESH AND WOOD MAKE MUSEUM TREES

TREES FOR exhibits in the American Museum of Natural History in New York are produced with saw, hammer, nails, and wire cutters instead of the customary seeds, sun, and rain. Museum workers first study photographs of the trees to be copied, then form skeleton trunks and branches of planks and beams. Wire mesh is fitted to these and papier-mâché applied to it. Then, if real bark is available, it is pressed onto the papier-mâché before it dries. If the bark is not obtainable, artists shape and color the still-damp papier-mâché into barklike patterns.

American Museum of Natural History creates trees for its exhibits with hammer, saw, and wire cutter

1 Wire mesh is nailed onto a wooden skeleton to form a foundation for the tree's trunk

2 Papier-mâché is daubed on the mesh, and an artist fits natural bark in place while it is wet

3 Bernard Chapman, artist, presses the last bark home and the artificial trunk is done

4 A natural branch having real needles and twigs is stuck onto the man-made trunk to finish the job

full COLOR television

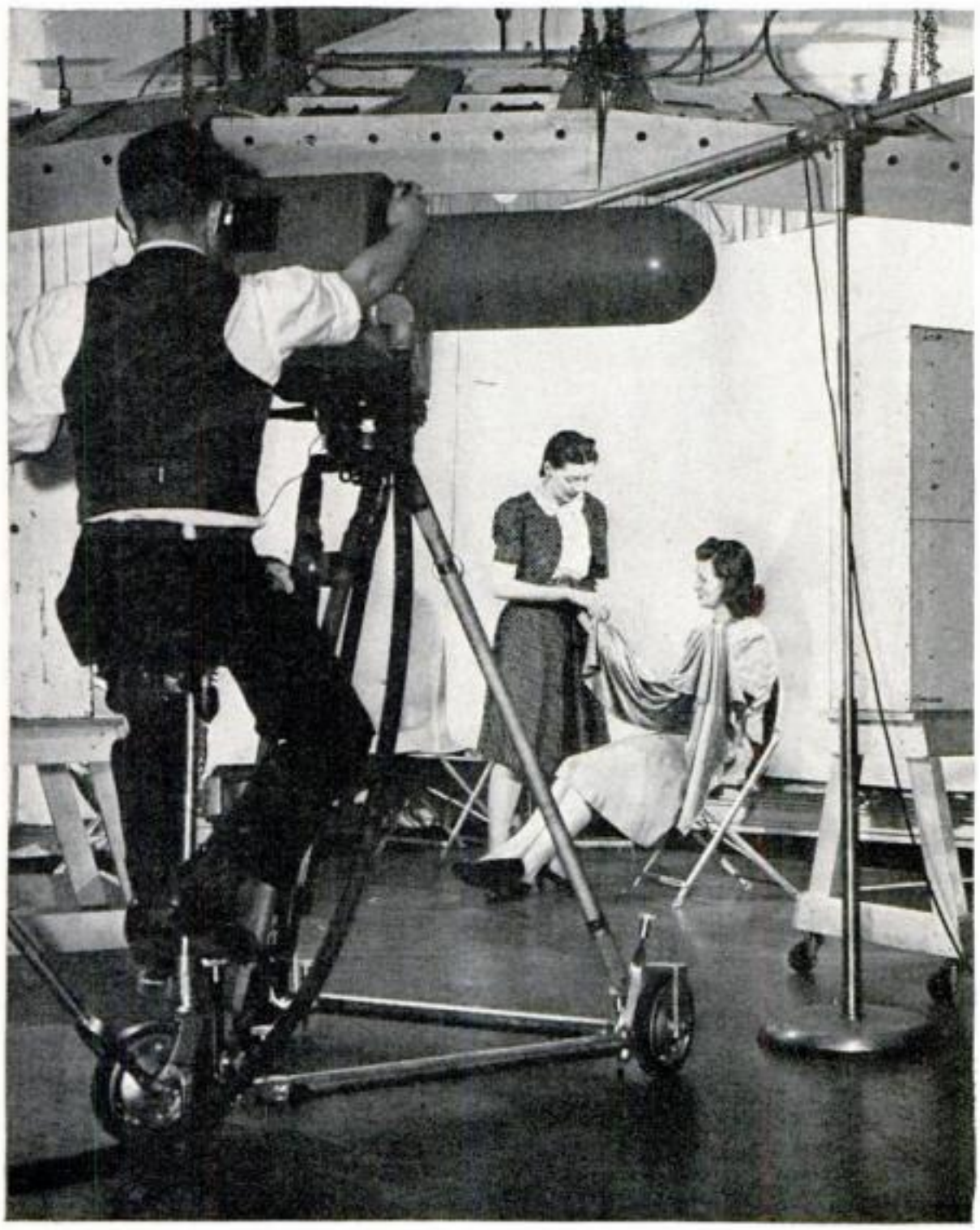
Cool to the touch, these brilliant fluorescent tubes replace the hot studio lamps under which the actors formerly perspired

SO NEAR is television in natural colors that, by the time you read these lines, observers at several dozen receivers already may be picking up test programs broadcast from the Chrysler Building in New York City. Test programming is the last step before this technical wonder, long in the process of laboratory development, will be ready for the public. And officials of the Columbia Broadcasting System, the pioneer of full-color television, predict that it may become the predominant system of the future.

Not long ago, C.B.S. research men, working under Dr. Peter C. Goldmark, were well satisfied when they succeeded in transmitting a "still" photograph in natural colors by television. From that, they progressed to televising color movies (P.S.M., December, '40, p. 120). Today, action views of living subjects in colorful costumes are being put on the air.

To accomplish these "live pick-ups," Dr. Goldmark and his aids have designed a unique television camera. What it does, briefly told, is to transmit images as viewed through red, green, and blue-tinted gelatin, in incredibly swift succession. How it does it may be seen in a diagram on page 67. One of the secrets of its remarkable performance, normally hidden from view in an extension that gives the camera its queer appearance, consists of a super-sensitive pick-up or scanning tube. Side and overhead banks of cool fluorescent tubes, yielding intense light without the uncomfortable heat of conventional studio lamps, also help to solve the problem of illumination.

Home receivers for television in colors, and in black and



Action! Camera! "Live pick-ups" in natural colors being demonstrated at the C.B.S. experimental studio with recently developed equipment

white, outwardly appear just alike. Those for color, however, will contain a revolving disk tinted red, green, and blue. Conversion units of similar design may adapt many present-day sets for receiving broadcasts in natural hues.

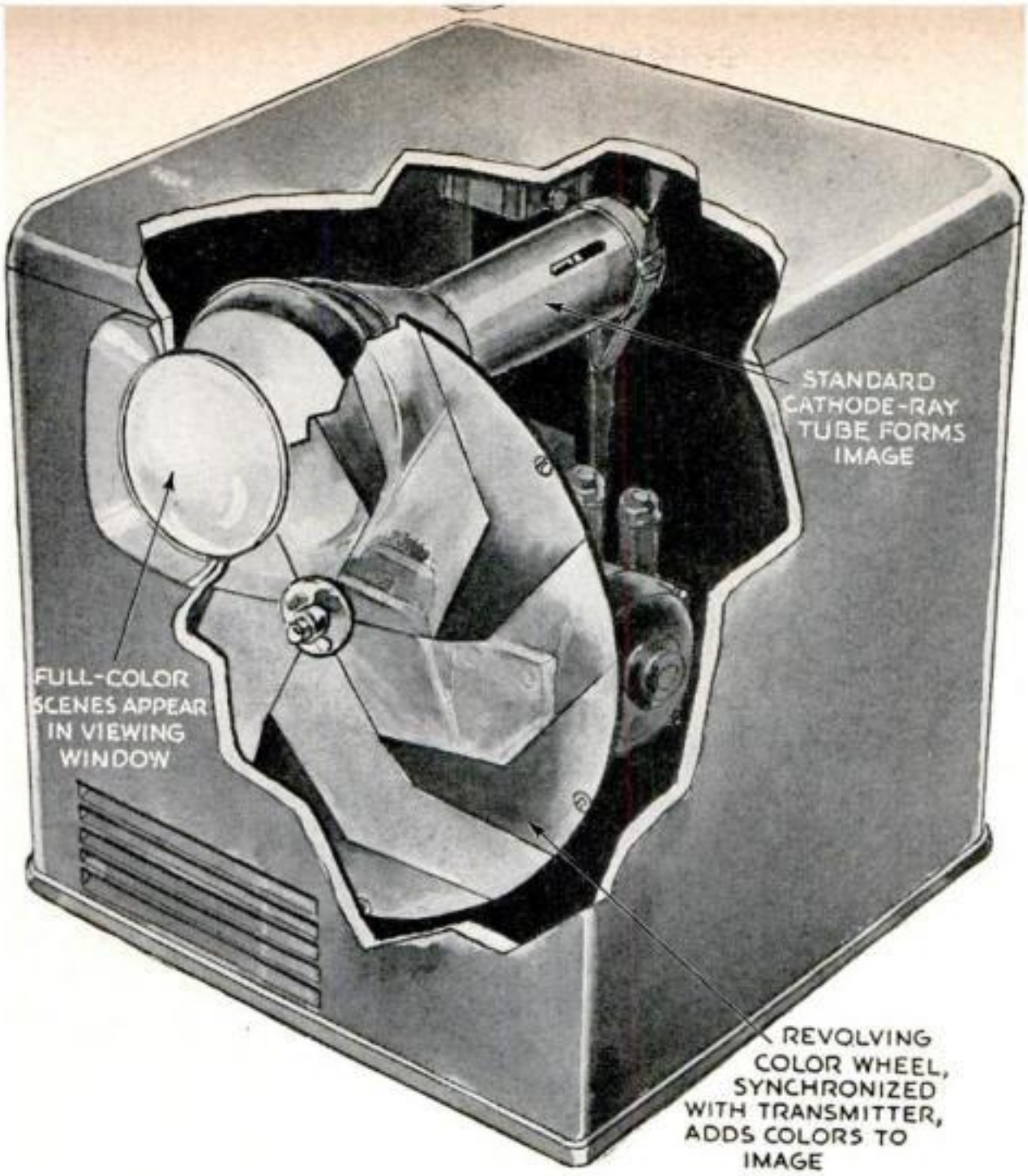
Color wheels in home receivers will be adjusted to turn exactly in synchronism with the color drum in the studio's television camera. In other words, a red filter will cover the window of the home receiver at the same moment that the studio camera is transmitting red parts of a scene. Green images, and blue, will similarly be matched. Because the human eye retains an image for a fraction of a second, it will fuse the three colors. The result will be a full-color scene, with intermediate hues of the spectrum formed by combinations of the filter colors. All three, together, give white. In a typical home receiver being used experimentally, a 7½-by-ten-inch color image is shown in the viewing window.

Possibilities in broadcast material for color television seem limitless. Its appeal to the eye in entertainment programs is only one of its many attractions. In a "telecast" of a football game, for example, the colors of the opposing teams' uniforms will help an enthusiast to identify the players and follow the action. Fashion shows via color television are naturals. Educational programs may include tours through famous art museums, exhibiting pictures in the same tints applied by the brush of the master. A chemical reaction may be portrayed in natural color during a scientific demonstration. In fact, color television makes possible many kinds of programs in which color plays an important part, and which could not be present in black and white.

As for studio technique, "live" and motion-picture programs may be alternated, just like original and transcribed programs on the radio. Or, as in a televised drama, the two may be combined—with the studio scene fading out into a movie, and then back again. Television standards of color fidelity, incidentally, are now so high that ordinary street make-up suffices for the cast. For special lighting effects, however, a skilled operator at a "color-mixing" panel may vary the blend of red, green, and blue, enough to give a street scene, at will, the tints of dawn, noon, and sunset.

A typical home receiver for television in color. The drawing at the right shows how a whirling disk combines red, green, and blue tints in a single image

And this is the unique camera designed by Dr. Goldmark and his aids. A key feature is a supersensitive pick-up or scanning tube that makes the new marvel possible

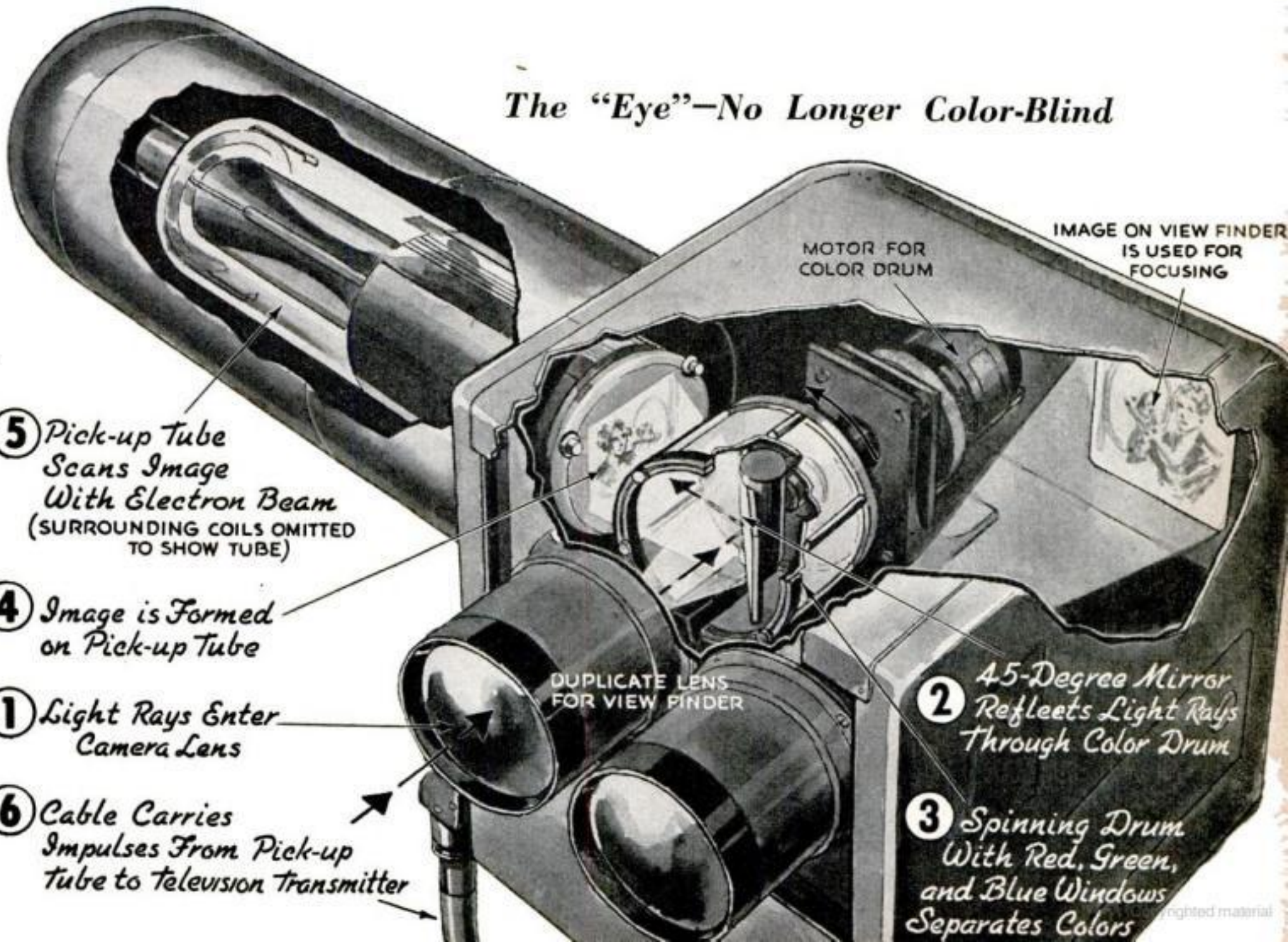


Home Receiver for Color Television

HOW COLORS ARE PUT ON THE AIR

In the color-television camera, images to be broadcast are scanned through panels of red, green, and blue gelatin in a rapidly rotating drum. The home receiver contains a revolving disk made up of transparent sections of the same colors, through which the image on the screen is viewed. This is synchronized with the drum in the camera, so that each portion of the image is viewed through a filter of the same color as that through which is was scanned, and the eye blends all into a picture in natural color.

The "Eye"—No Longer Color-Blind



Trees Get Injection Into "Blood Stream" To Kill Canker Germ

Nestor Caroselli, a pathologist at the Bartlett Tree Laboratories, of Stamford, Conn., demonstrates his revolutionary treatment. Below, a hole is drilled for the medicine

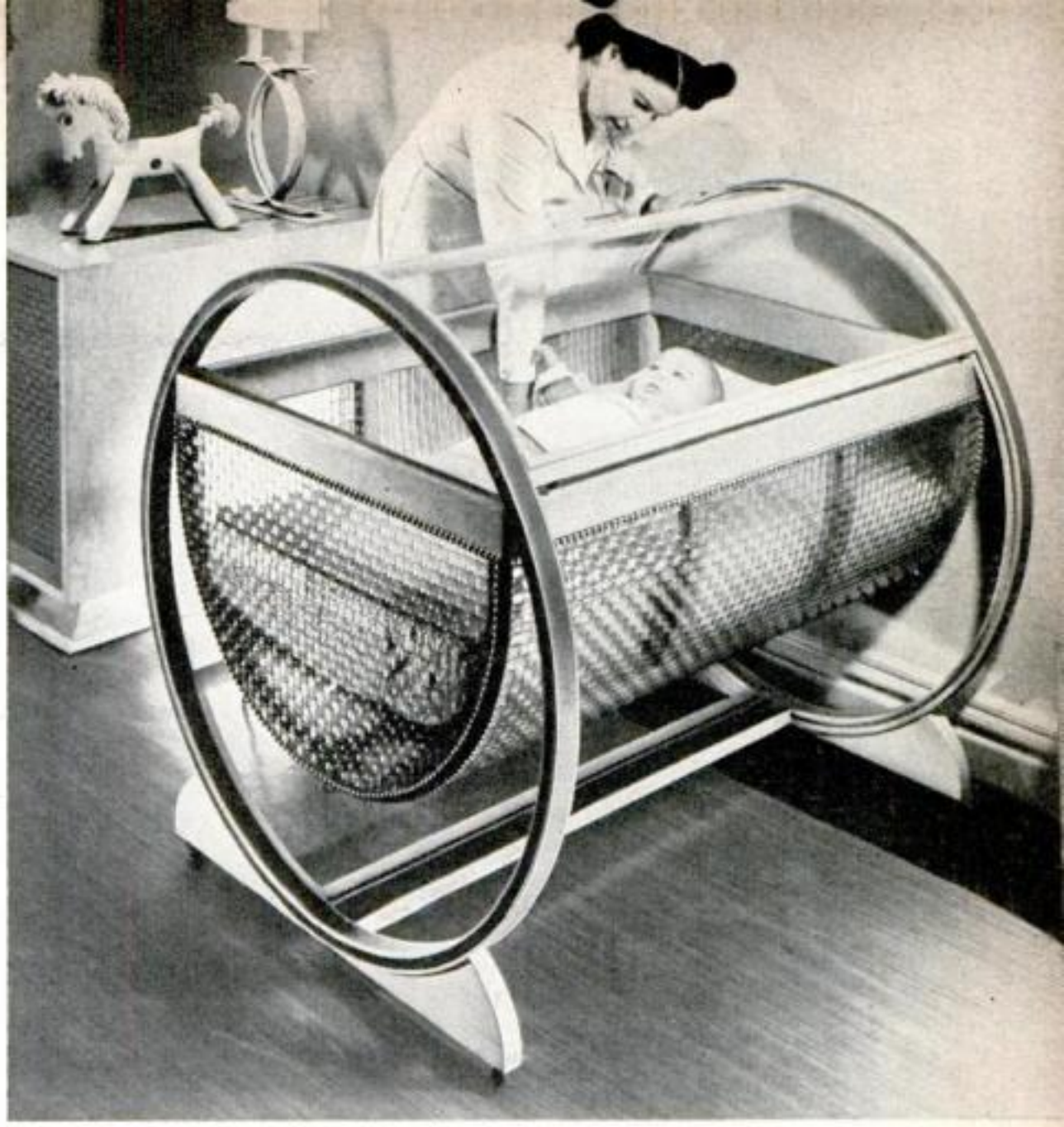
A NEW METHOD for treating the bleeding canker disease in trees, similar to the injection of serum into the blood stream of a human being, has been developed by Nestor Caroselli, assistant pathologist at the Bartlett Tree Laboratories, of Stamford, Conn. The method is also being used in treating other tree diseases, and has been called as important to tree culture as Pasteur's vaccine for rabies is to man. Caroselli, first isolated the canker germ, then developed the serum for injection. Treatments so far are reported 88 percent successful.

Germans Boast that They Have a Long-Range Bomber . . .

The German Flying Spindle, a long-range bomber that is the successor to the Flying Pencil, is so maneuverable that it can be used for hedge-hopping, the German Library of Information boasted, in submitting the striking photographs below. Hedge-hopping, as flying a few feet above trees is called, is of great tactical value for strafing ground troops and cleaning out machine-gun nests. It is extremely dangerous, even in peacetime, since the smallest air pocket is liable to pancake the plane onto the trees, and in wartime, with troops firing at close range, the ship must be able to turn and twist like

Transparent Crib Looks Fragile But Is Really Strong

PAUL BRY and Jo Kim, of New York City, have designed a baby's crib of transparent plastic that is as serviceable as it looks fragile. The bassinet of woven Tenite is hung between two large round rings of bleached walnut, covered with sky-blue leatherette. Two shields, of a plastic sheeting framed in walnut, slide up on the end rings to cover the bassinet wholly or partially as desired, thus making it possible to protect the baby against drafts and cough germs. All the materials used in building the crib are washable, strong, and durable, though the transparency of the plastic and delicate baby shades make it look frail.

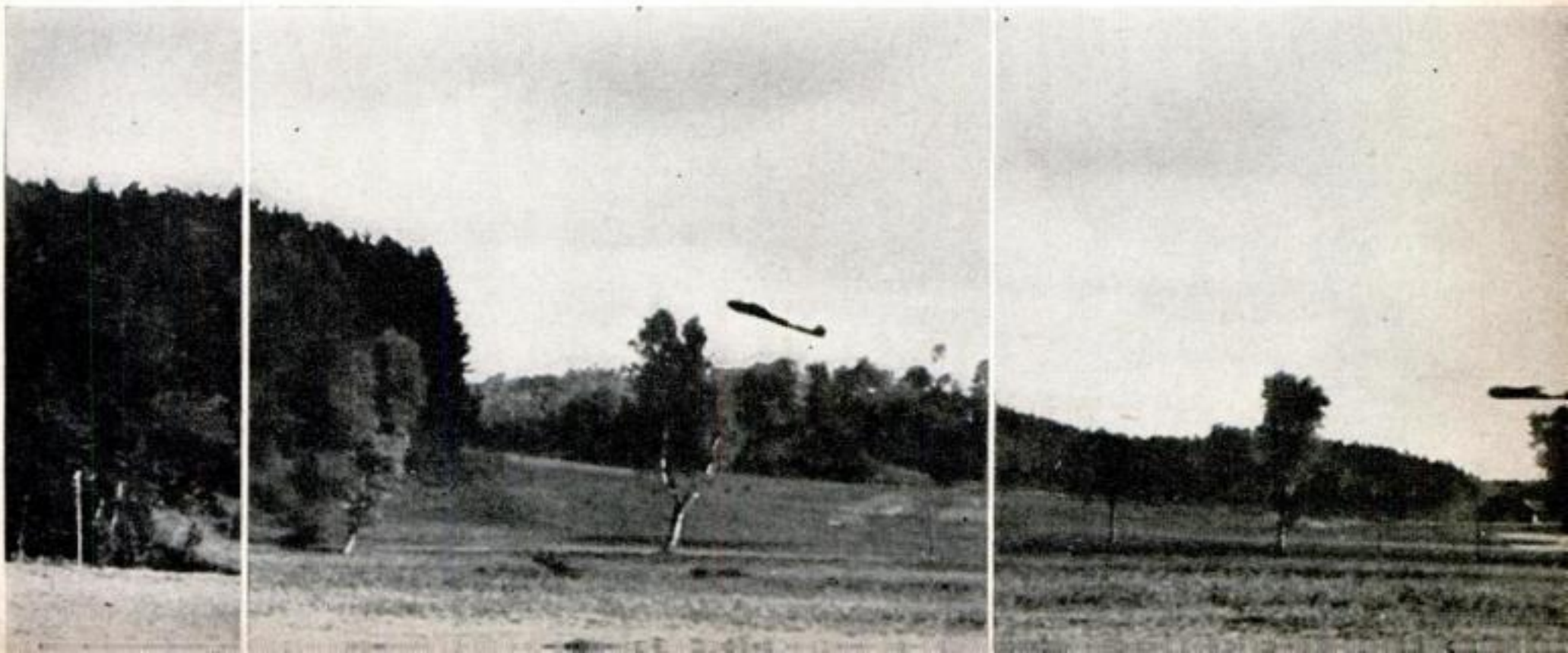


Two shields of a plastic sheeting, framed in walnut, slide up on the end rings to cover the top of this woven Tenite bassinet

The same designers have made matching chests for the baby's clothes and other nursery articles. The tops of the chests are laminated with plastic sheeting and are of a pale salmon color, the wooden door frames are covered with the sky-blue leatherette and the panels are of the same woven transparent Tenite used in making the bassinet. Soft blue linoleum covers the floor, and the walls are painted a pale blue.

. . . so Maneuverable It Can Be Used for Hedge-Hopping

a pursuit plane if it and its pilot are to finish their job and return to their base all in one piece. Few bombers have ever been that adroit. Comparable would be a battleship able to turn as swiftly and easily as a destroyer. Bombers are too expensive for most hedge-hopping operations, but a bomber that can hedge-hop as easily as this can twist out of the way of enemy pursuit craft, and also fly lower than most bombers can do with any hope of escaping antiaircraft fire. The photographic sequence purports to show the new bomber skimming along the contour of a distant hill.



Naval surgeons give all applicants for appointment as flying cadets a thorough physical examination

Picking 40,000 Pilots a Year

THE GOVERNMENT expects to be turning out pilots at the rate of 40,000 a year before the end of 1941. The Army's quota is 30,000 and the Navy's 10,000. That's nearly three times as many as the Army was graduating only last spring and nearly twice as many as the Navy was producing. To achieve its goal, the Army has contracted with fifty private schools to give the first ten weeks of elementary training. It expects to continue a little elementary training at Randolph Field, at San Antonio, Texas, but this plan has released the Army's fields largely for what is called basic and advanced instruction. From the contract schools cadets go to Randolph, Maxwell Field, at Montgomery, Ala., or Moffett Field, at Sunnyvale, Calif., for the ten weeks of basic training. Most remain there another ten weeks for their advanced instruction, but some receive theirs at Kelly Field, at San Antonio, or at San Angelo, Texas, or Stockton, Calif. By enlarging its school at Pensa-

A tilting table is used to test the effect of a dive on the heart. Some lose consciousness too easily to make good pilots

The seismograph records the brain waves. Variations from the normal may indicate abnormal mental functions. Below, a gun is fired to startle a cadet and the pounding of his heart is checked. The other boy sniffs oxygen to test his metabolism

Photos by Harold Kulick

cola, Fla., and building new schools at Corpus Christi, Texas, and Jacksonville, Fla., the Navy will be able to turn out its full quota without resort to private schools for preliminary instruction.

To produce 40,000 pilots a year, the armed services need more than 70,000 men to begin training, for in practice only 57 percent of those who start get their wings. No one is drafted for the air service, and that's a lot of volunteers, but Uncle Sam isn't worried. Requirements remain as strict as ever, though enlisted men may soon be accepted for training as pilots even though they didn't go to college and can't pass an equivalent examination. The plan is to graduate them as flying staff sergeants, the Army's first non-commissioned flyers.

Candidates for appointment as flying cadets must be unmarried, citizens, and between 20 and 27 years old. They must have passed two years of college work, or be able to pass the equivalent examination, and whether they went to college or not, they must take a physical examination far tougher than that required for enlistment in most of the other armed services. Anything that will disqualify you for enlistment, such as not enough teeth that meet, will disqualify you for the Air Corps. In addition, to be accepted as a flying cadet you must be at least five feet four inches tall and not taller than six feet four inches; have completely normal hearing and vision, without glasses; sound lungs, heart and nervous system, a stable sense of balance, and a "temperamental constitution suitable for military flying."

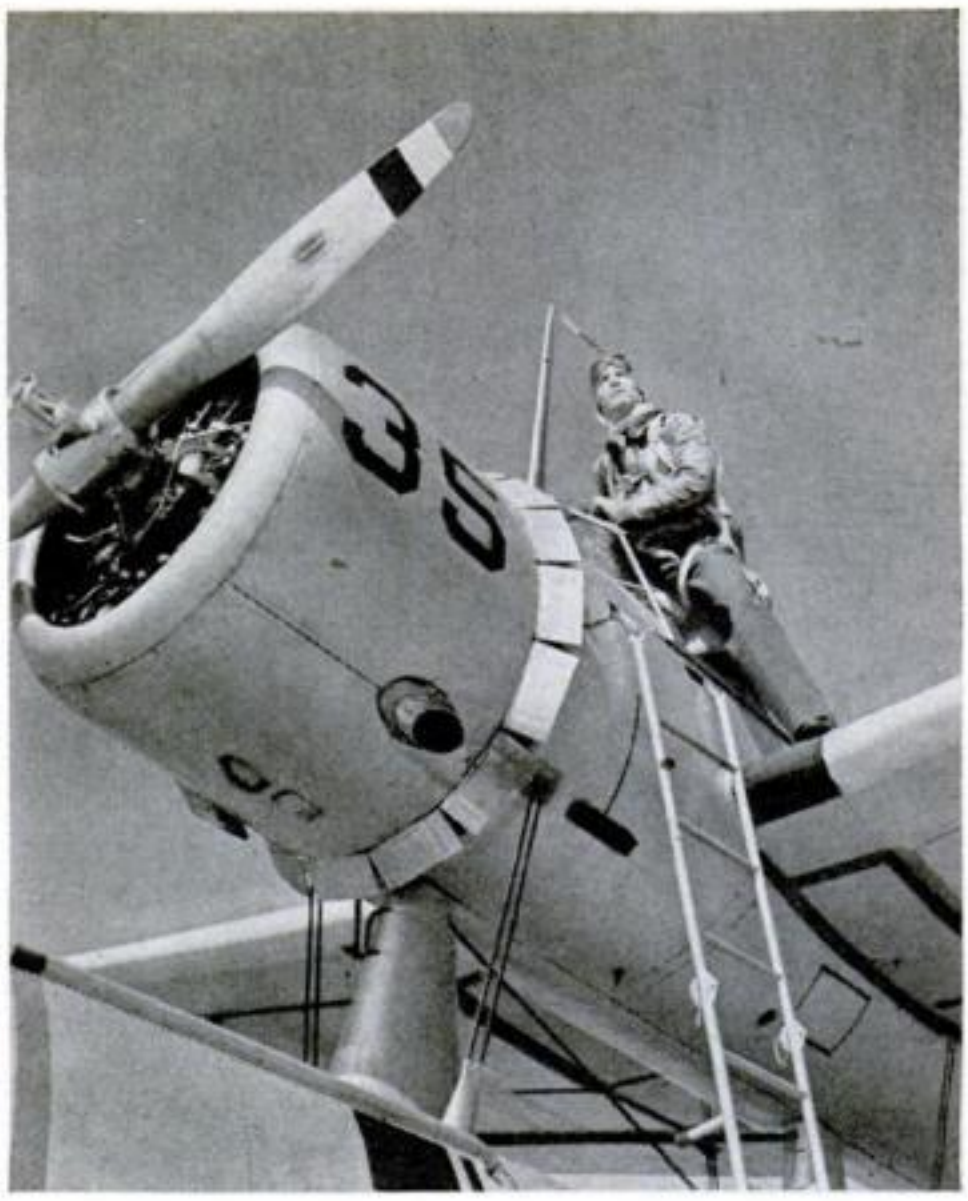
It's pretty difficult to find out this last in

Our Cover

Paul Dorsey made the color shot on the cover of Philips K. Isham, a 25-year-old flying cadet from Flagstaff, Ariz. Isham was sent to Kelly Field, at San Antonio, for his advanced air instruction

advance. In an attempt to do it, both the Army and Navy put new cadets through an elaborate system of tests in an "experimental flight research laboratory." Typical tests used by the Navy at the Pensacola air station are shown in the accompanying photographs. A tilting table is used to show the effect of a power dive on the heart, the electrical energy caused by thinking, or at least the activity of the brain cells, is measured on a seismograph to reveal any abnormal mental functions, and cadets sniff straight oxygen to test their metabolism. They are startled by the firing of a gun, and the action of their hearts is recorded. They are tested for balance and sway by being spun around with their eyes closed, then they go to a coördinating machine to determine how quickly they can get their arms and legs moving to execute maneuvers. The machine is equipped with two sets of lights, red and green, and the cadets must manipulate controls in an effort to match with green lights a series of commands relayed by red lights.

Because the United States still regards these laboratory tests as experimental, men are not washed up when they fail to pass them, but their reactions are later checked with their flying ability and it is expected that in time their use will weed out in advance many who now aren't dropped until after several weeks and sometimes months of flying instruction. Similar tests are being used with considerable success by the British and German air forces. They save money and heartbreak, and also release additional training capacity which otherwise would be wasted on men who do not possess the special qualifications of military flyers.



Watching his buddies before an advanced flight

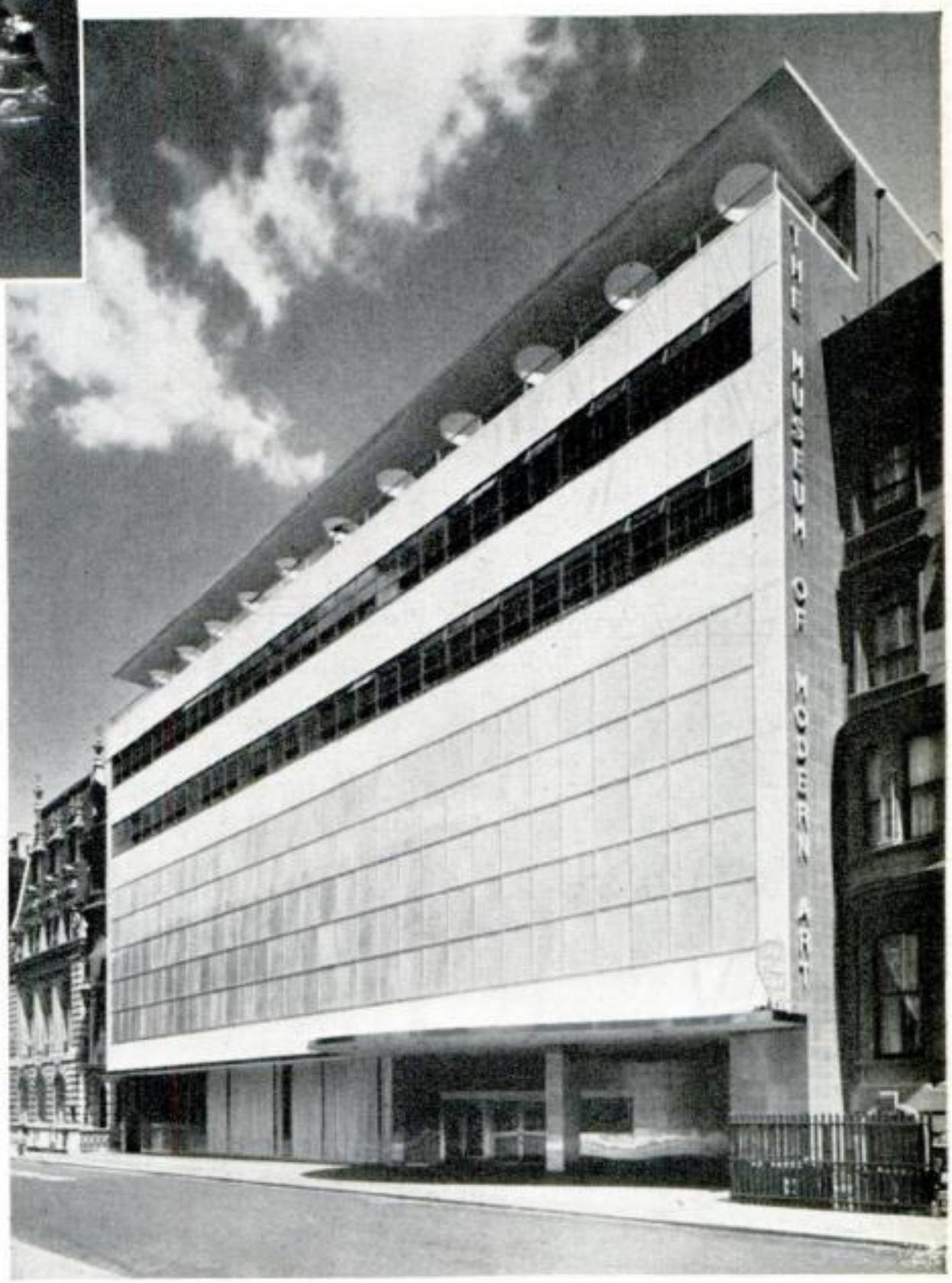
The cadet manipulates the controls of the machine to match with green lights maneuvers relayed to him in red, to reveal the speed of his reactions

This gadget shows an aviator's sense of balance. He shuts his eyes, and the little weights on the strings attached to his head measure his swaying

LIGHT CONDITIONING

New Products of Glass Industry Enable Architects and Builders To Control and Direct Daylight

Glass helps control light, from the heat-resisting chimney of the old-fashioned oil lamp . . .



. . . . to light-diffusing Thermolux windows for modern buildings

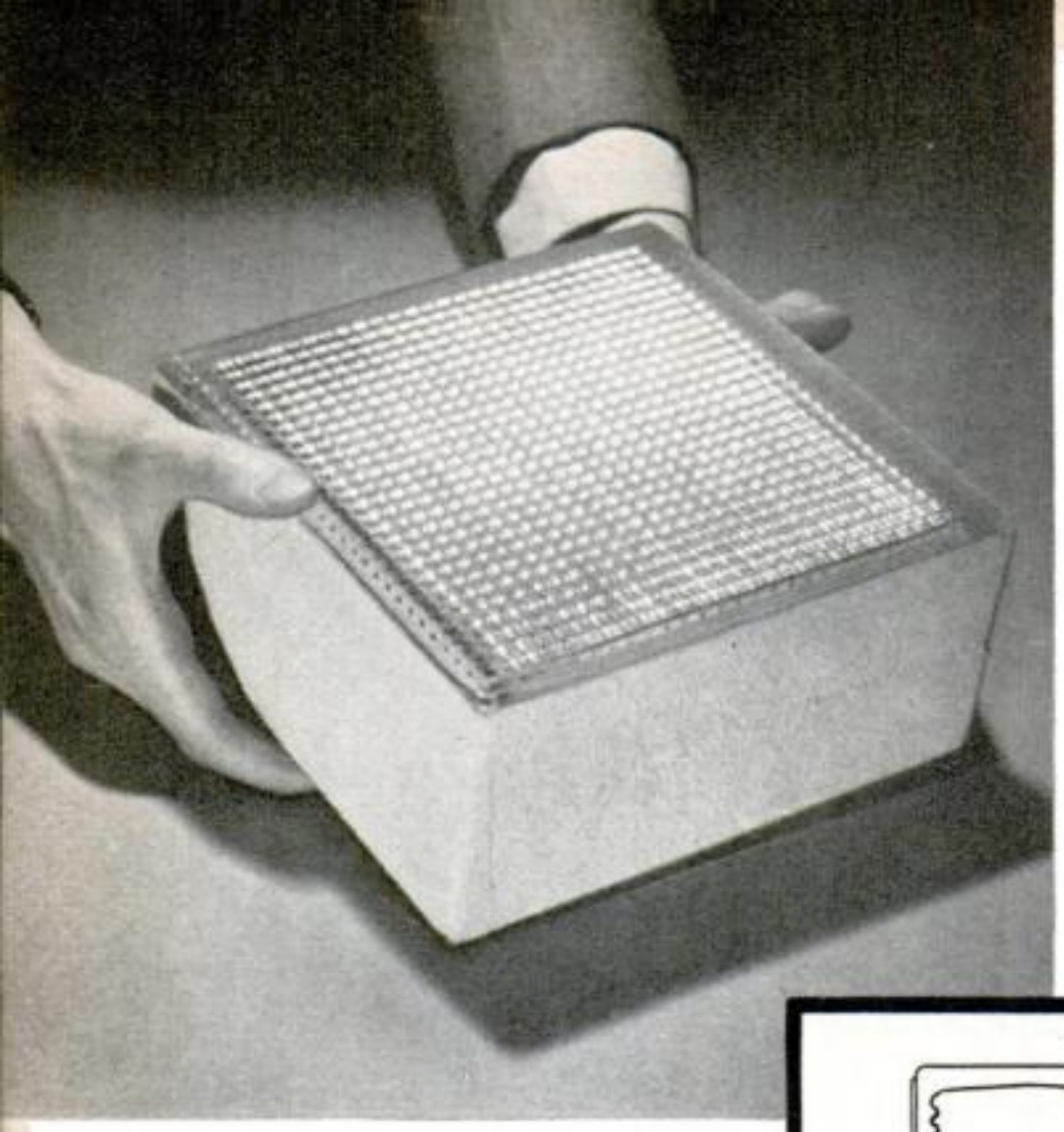
By

EDWIN TEALE

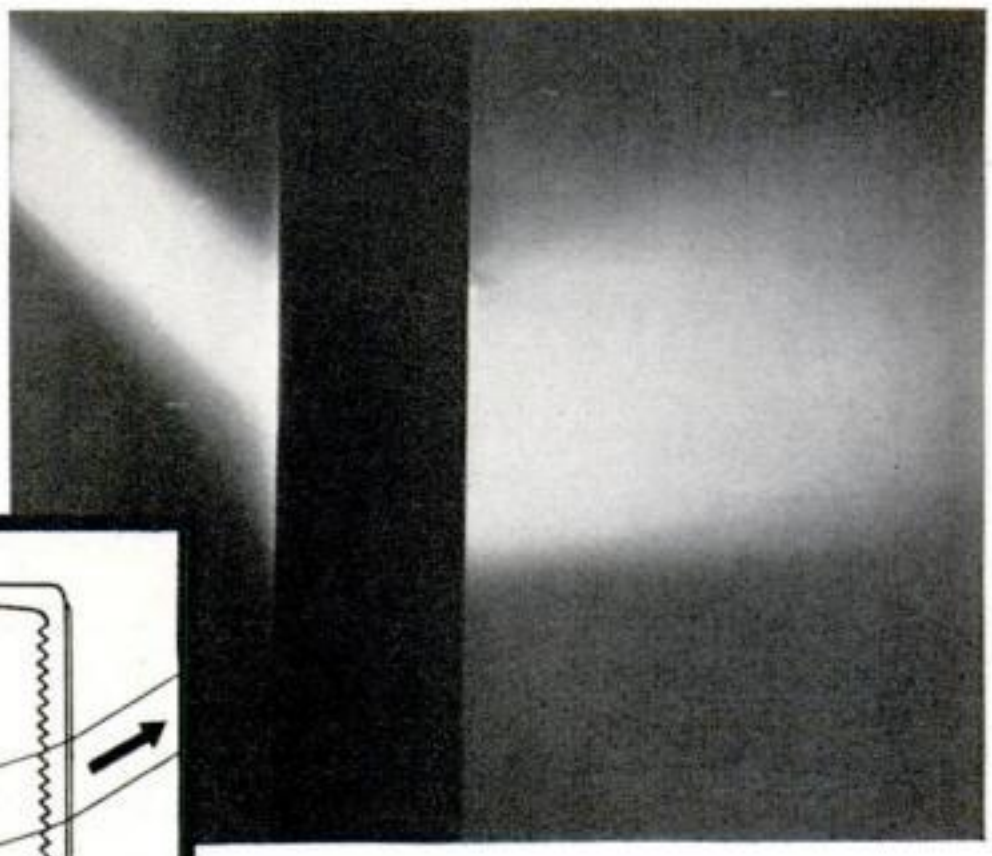
BECAUSE a special kind of glass has been installed in the windows of the Curtiss-Wright plant, near Buffalo, N. Y., the metal fuselages of fighting planes are moving faster along the assembly line. If ordinary windowpanes were used, the glare from the polished metal on sunny days would cause discomfort and cut down efficiency. By substituting the new glass, which eliminates most of the heat and glare from sunshine, the company has increased production. At Wichita, Kans., 14,830 windowpanes in the recently completed Cessna Aircraft factory are formed of the same light-conditioning material.

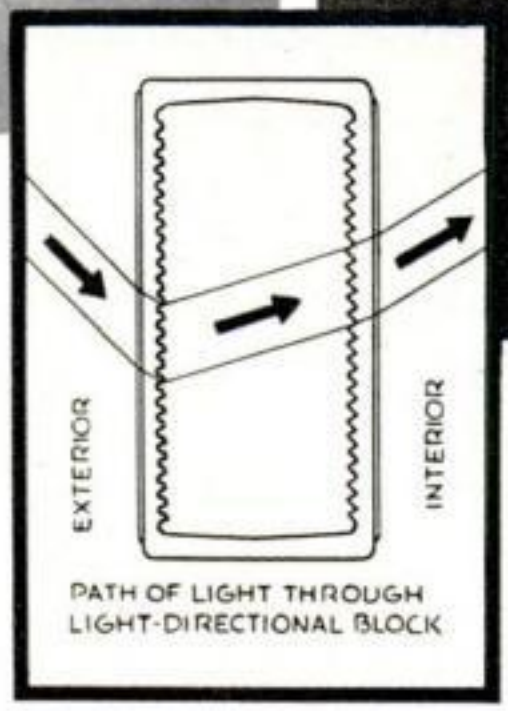
Light conditioning is a term you will hear with increasing frequency during the next few months. It represents a major development in the glass industry. New products permit the builder of today to direct, diffuse, and control daylight in a manner impossible before. Light conditioning means greater safety, comfort, and efficiency for homes and factories.

One of the most recent developments in the field is a translucent sandwich formed of two sheets of clear glass with woven spun glass hermetically sealed between them. Known as Thermolux, it both directs and diffuses the light. In addition, it provides insulation against sound, heat, and



Light-directional glass blocks, built into walls in place of windows, enable modern builders to control daylight as well as they can artificial light. The photograph below shows a beam of light passing through such a block. The rays are bent and redirected, as seen in the diagram





PATH OF LIGHT THROUGH LIGHT-DIRECTIONAL BLOCK

cold. At the Museum of Modern Art, in New York City, 3,500 square feet of Thermolux cover almost the entire front of the building. Tests have indicated that the diffused light coming from such windows actually penetrates farther into a room than a more brilliant glare. In passing through Thermolux, the rays of light are spread out at right angles to the direction of the glass fibers. Thus, when the windows are installed with the spun glass running horizontally, the light is thrown toward the ceiling and floor.

Heat, as well as glare, is filtered out by another glass development which, after nearly a decade of laboratory research, appeared on the market a couple of years ago. During the process of manufacture, an ingredient is added to this glass which filters out the infra-red, or heat, rays from sunlight. New jobs for this new glass are coming in rapid succession. Its use in plane factories is but one of its many applications.

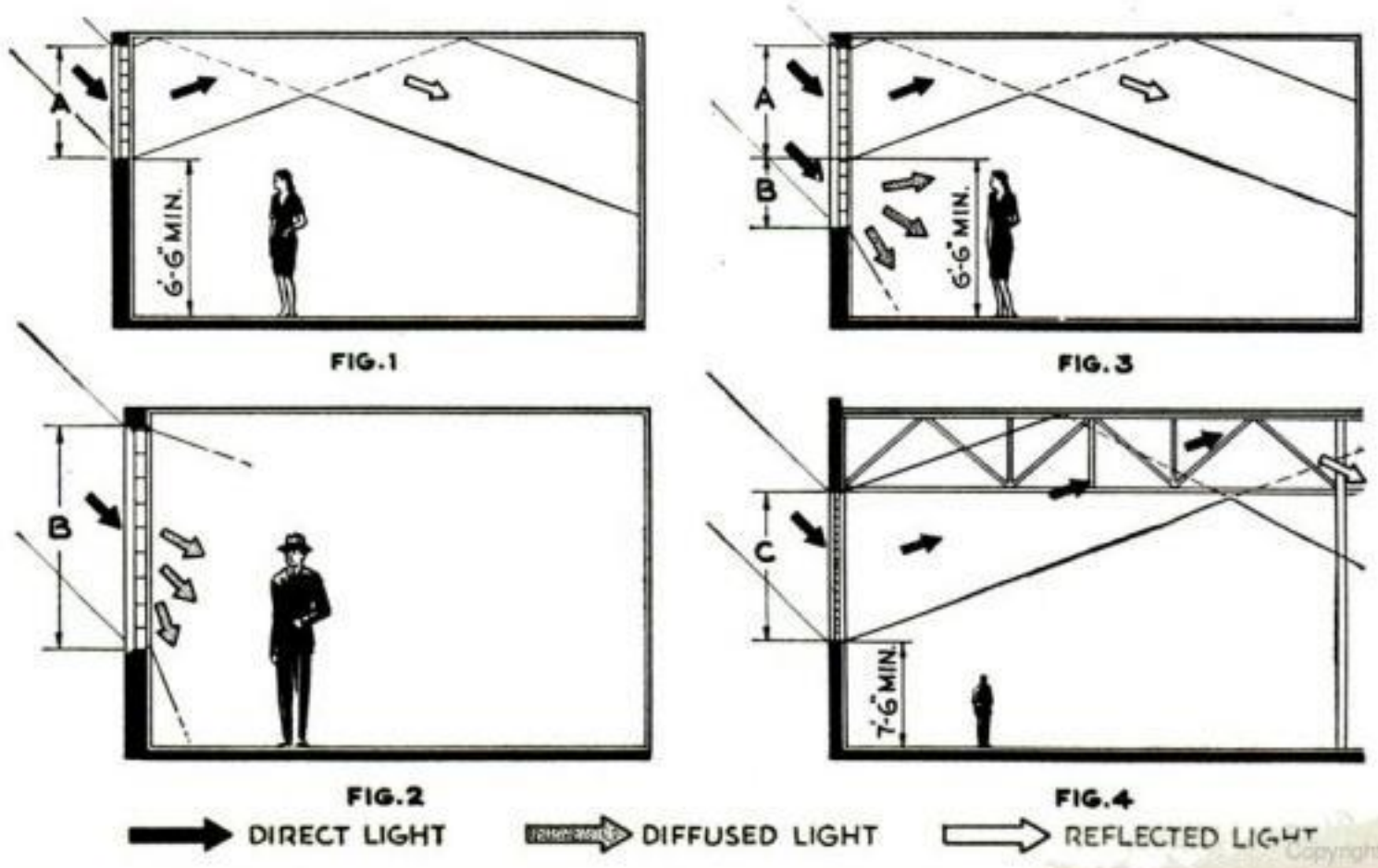
In Boston, Mass., a florist whose show window faced west, found that the heat of the afternoon sun wilted his blooms. By installing the heat-filtering glass, he solved

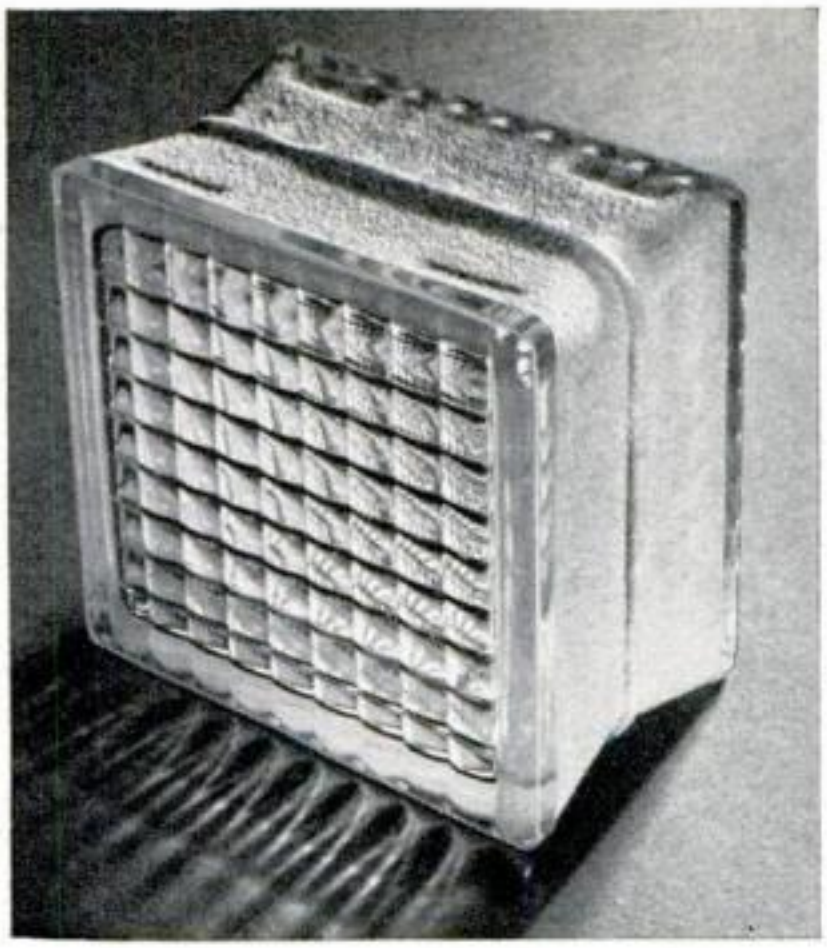
1 Glass blocks direct light onto ceiling, which reflects it downward

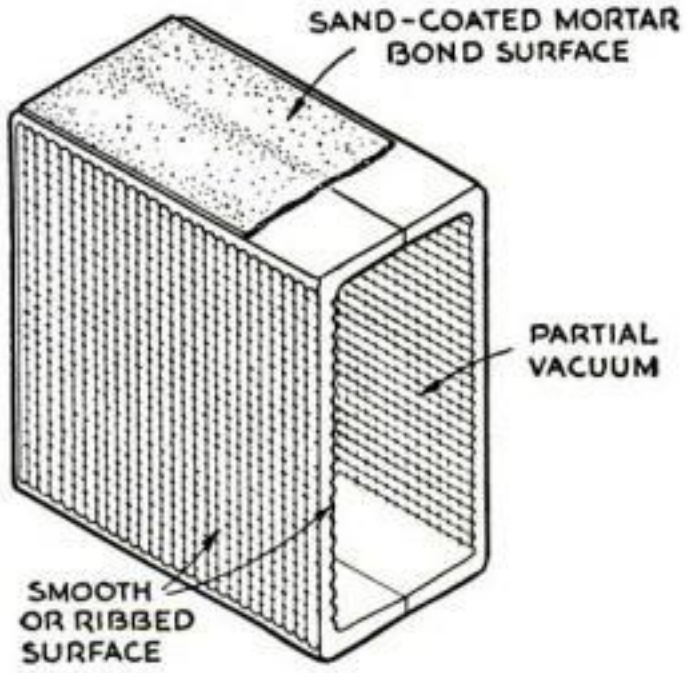
2 Here light falls in the room, but is diffused. Glass is not transparent

3 This arrangement of blocks combines direct and reflected light

4 For wide buildings, a variation of Figure 1 is used to spread the light







Metal framework permits glass blocks to be assembled in a wall without mortar. When mortar is used, concave edges seen at upper left give a good grip. The drawing at left shows the structure of a typical glass block

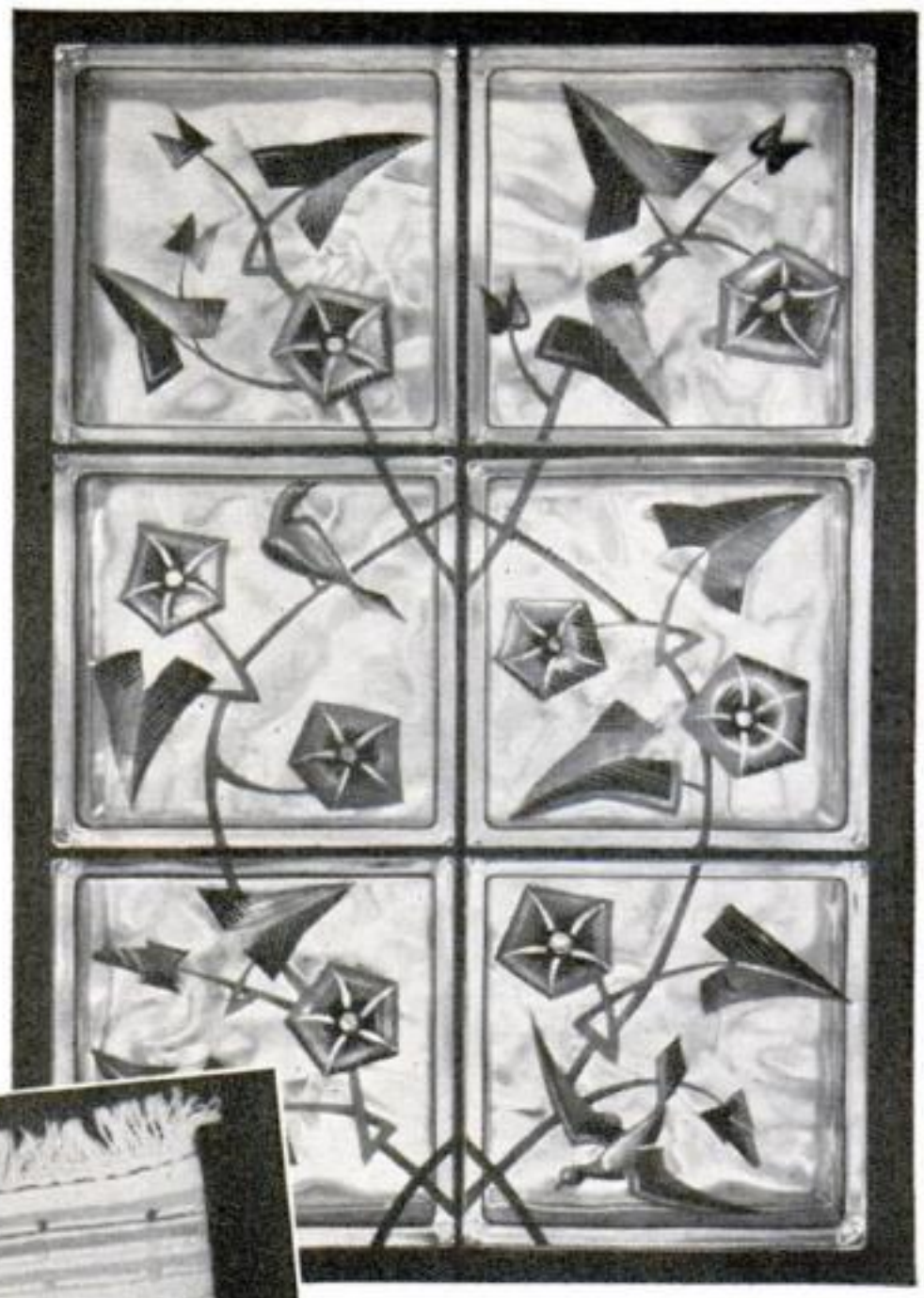
his problem. In Chicago, Ill., the president of a large concern occupied an office with an eastern exposure. In spite of drawn blinds, the room became unbearably hot on summer mornings. He installed windows which cut out heat rays and the office became many degrees cooler. An Illinois railroad has equipped fourteen passenger coaches with windows of the new glass to increase the comfort of those on the sunny side of the train. A by-product of this installation has been the discovery that upholstery in these coaches is lasting longer than in other cars.

At the opposite extreme in window glass is a new type so crystal clear it transmits 91 percent of visible light. You can look through a 24-inch pane, held edgewise, and see an object almost as clearly as though no glass were present. Known as Crystalex, this water-white plate glass provides almost perfect vision in windows of houses that overlook lakes, mountains, or other scenic surroundings. In show cases, it displays jewelry and art objects to best advantage. And, in laminated bulletproof glass for cashiers' cages, it provides increased visibility.

Since 1935, when glass blocks were first introduced to architects and builders, more than 10,000,000 of these constructional units have been sold. One of their latest jobs is speeding up the building of defense factories. Instead of installing regular windows and sashes, contractors are saving time by substituting sections of glass blocks. A further aid to the speedy assembly of such blocks has been developed by engineers of the Owens-Illinois company. This is a lightweight metal framework which replaces mortar. Such frames have the additional advantage of permitting complete salvage of metal and blocks if a wall or partition has to be taken down. In defense plants, glass-block windows permit light to enter but prevent outsiders from looking in.

Another ingenious application of light-

Powdered colored glass fused on the surface of a block forms a decorative design. Such blocks are combined in patterns, as at the right, to give the effect of stained glass



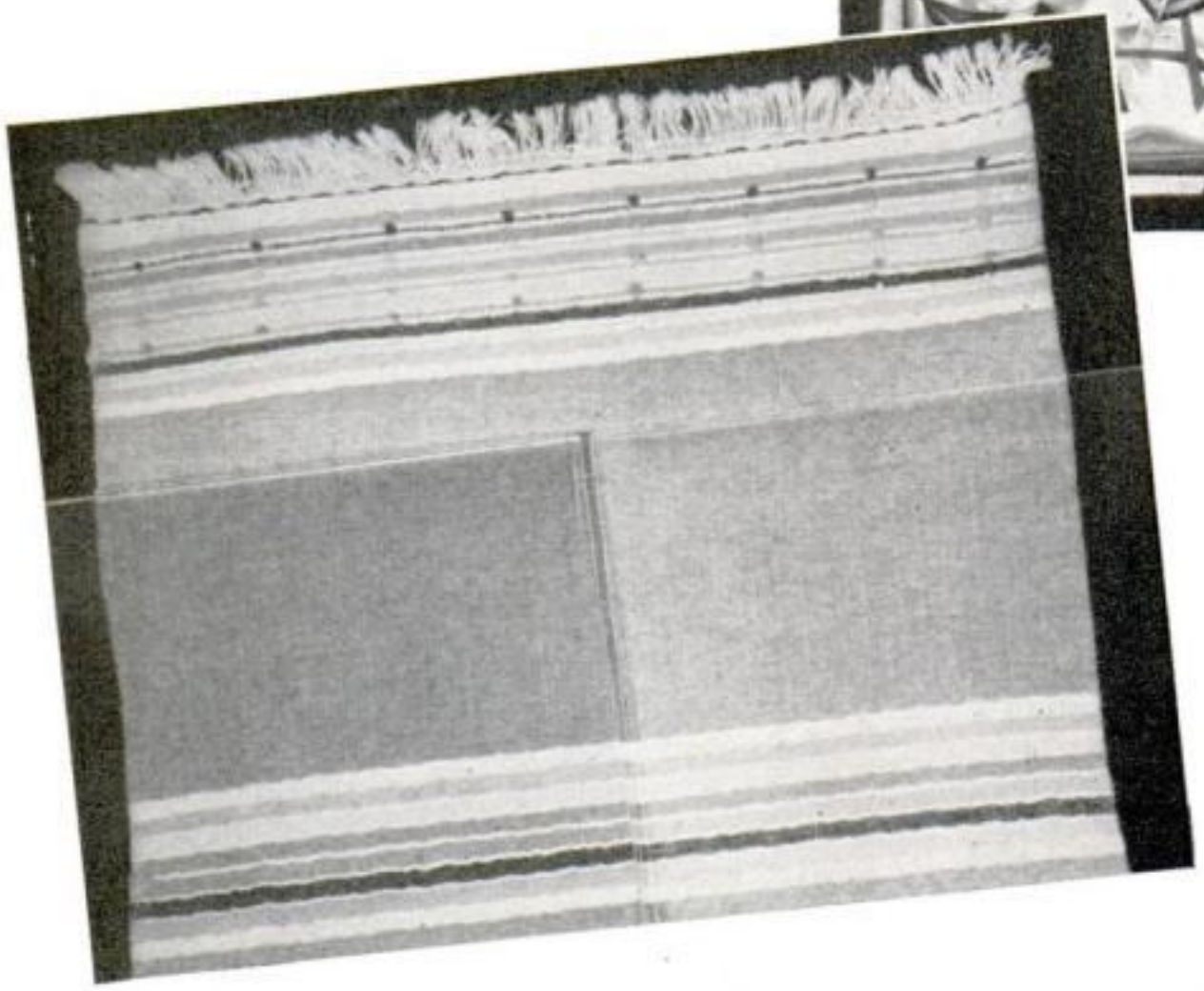


Photo at left shows a rug viewed through Crystalex (on right-hand side) and through an ordinary window glass. Crystalex transmits 91 percent of visible light

conditioning materials to defense is suggested by Harold A. Breeding, General Electric engineer. He plans automatic blackouts for factories that operate at night. By using sodium lamps in the plant and blue glass in the windows, he points out, a factory could have its interior brightly illuminated and yet appear perfectly dark from the outside. Blue glass absorbs yellow light.

Within recent months, glass blocks have appeared in a variety of new shapes and designs. Corrugated edges prevent stray beams from shining between them after they have been placed in a wall. V-shaped corners increase the amount of holding cement and provide stronger construction. Knobs and ripples, lines and grilles incorporated in the faces of the blocks bend and control the light rays. By selecting patterns that will diffuse or direct the light, the modern builder can employ daylight, as an illuminating engineer uses electric light, to meet the individual needs of a given factory.

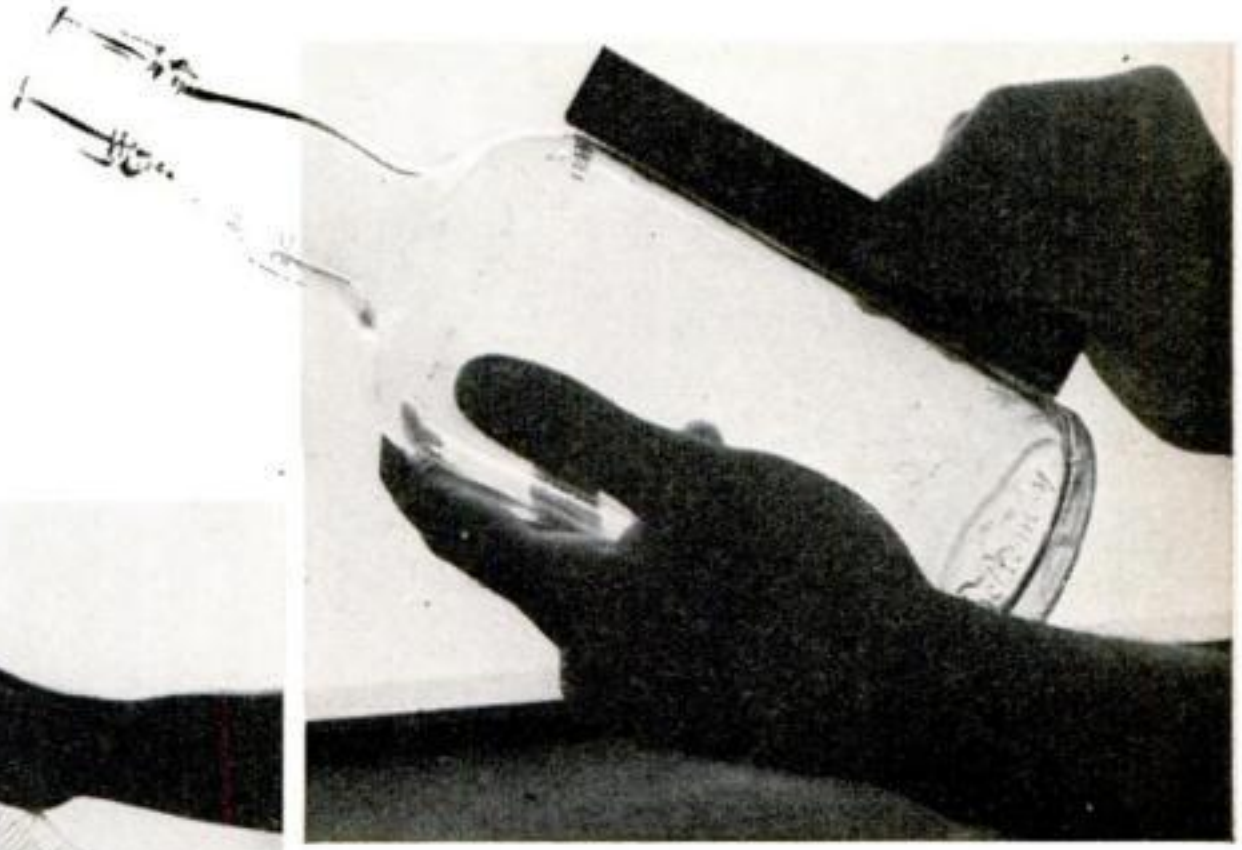
The most recent departure in glass-block design permits unusual decorative effects. Powdered glass, in various brilliant colors, is applied to the surface of blocks by means of stencils and then fused in place. The result is a nonfading design which is part of the block itself. Light coming from behind a wall formed of such decorative units produces the effect of stained glass.

BOTTLES TAKE A "SINGING LESSON"

KNOCKING empty bottles together to check their "tone" and "feel" is part of the job of A. W. Hortenstine, chief glass tester for the Old Quaker plant of Schenley Distillers Corporation, Lawrenceburg, Ind.

To assure uniform quality, Hortenstine makes a bottle-by-bottle inspection of at least 50 cases out of every carload of 1,500 cases received at the plant. Besides the "audition," he examines bottles under polarized light from a device of his own construction.

Since bottles with concave sides are hard to label, straightness is gauged with a ruler. To check capacity, water equal in amount to the fluid they are supposed to hold is poured into the containers.



High C, please! At top, two empty bottles sing a duet for the critical ears of A. W. Hortenstine. He judges them by "feel," too

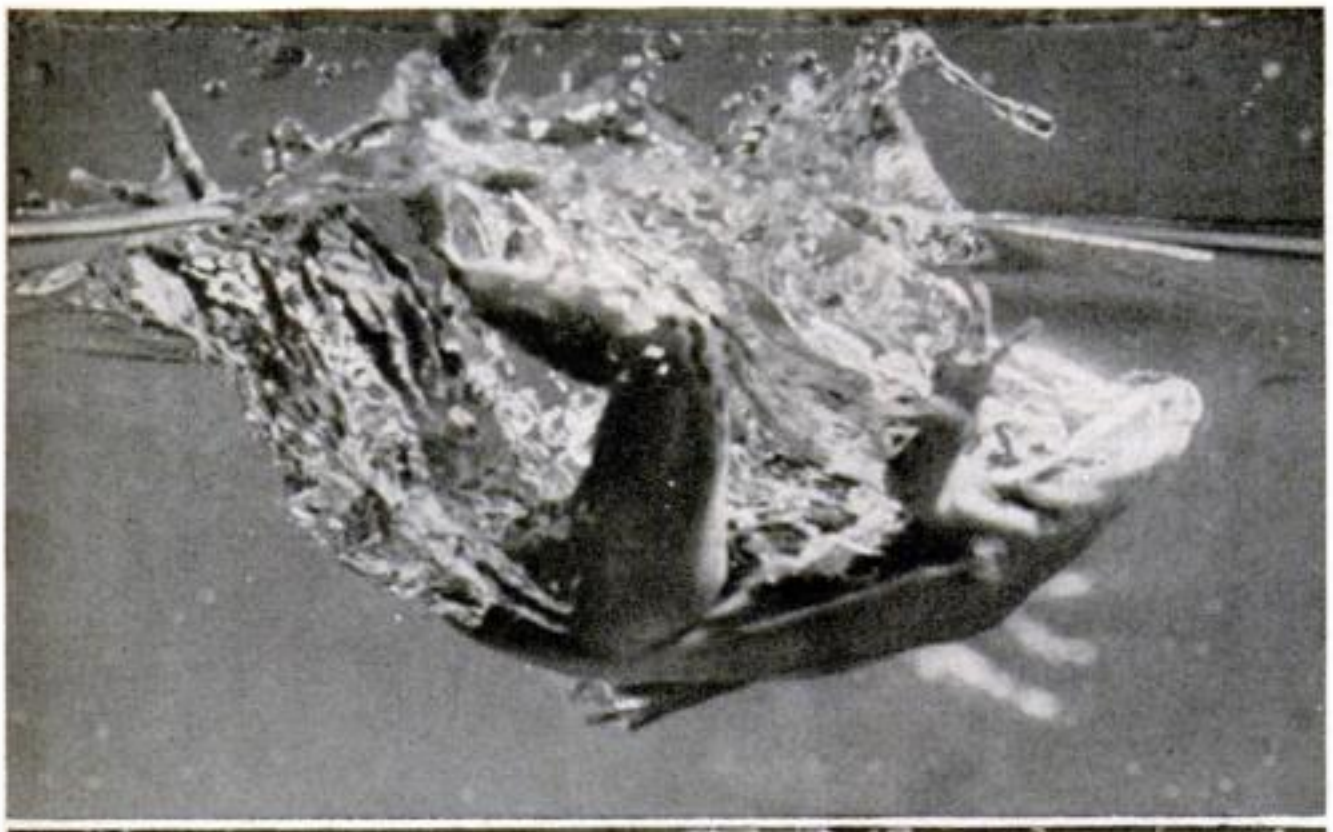
Slim waists are not the style. Above, the ruler laid along the side of a bottle shows whether it is straight. It is hard to make labels stay on bottles with concave sides

Bottlenecks are eliminated—if they aren't the right size. A measured amount of water is poured into a bottle. It must come up to just exactly the right point in the neck

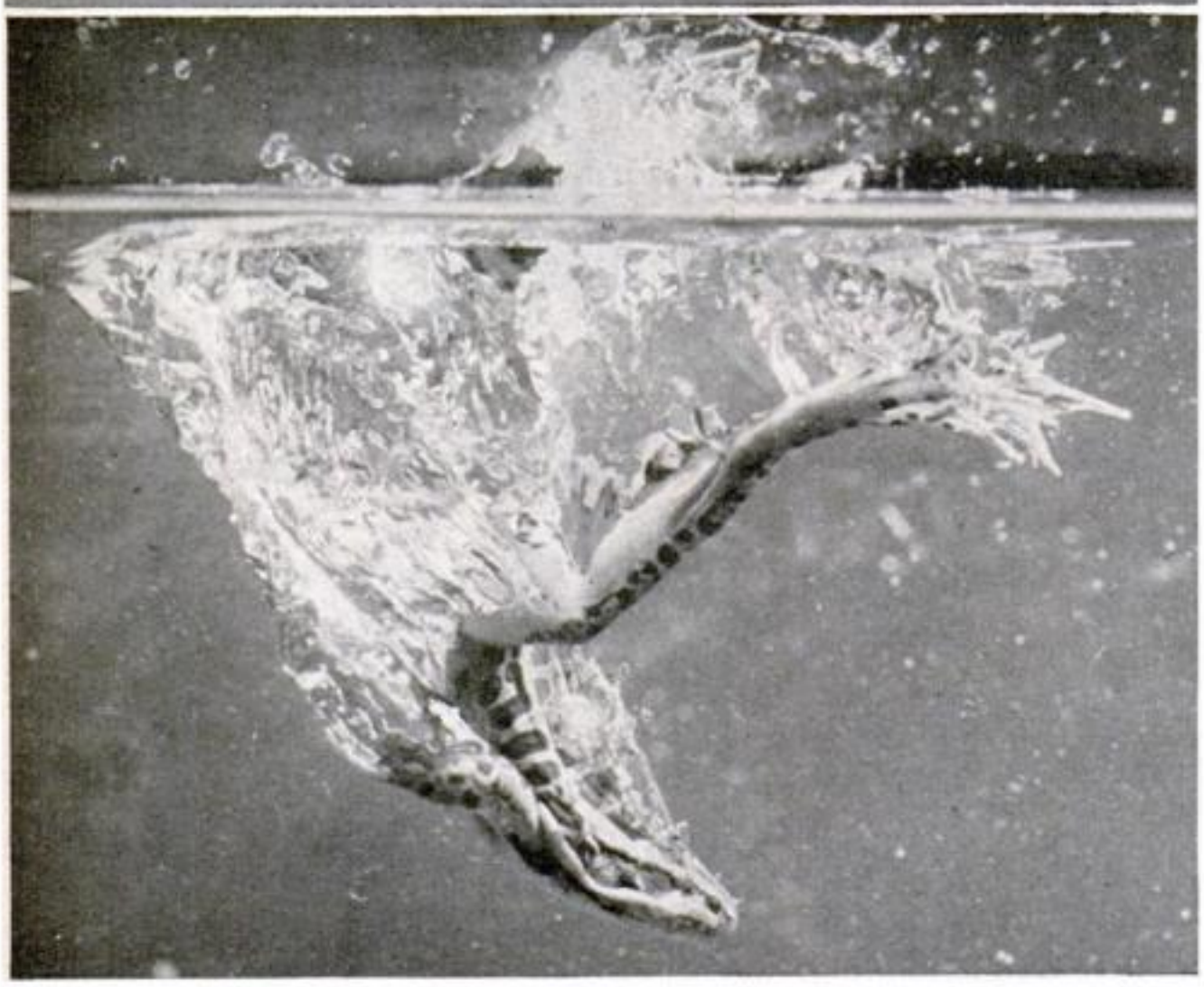
"Belly-Whoppers"

HENRY B. KANE'S 1/30,000-SECOND PHOTOS CATCH A FROG DIVER OFF GUARD

FROGS have been leaping into water for 100,000,000 years. Yet, they still make the same mistakes as any swimming-hole schoolboy. How they often hit the water in splas ıing belly-whoppers, or with their long, spr:ngboard legs flying too far ahead over their backs, is revealed in this series of ultra-high-speed flash shots recorded by Henry B. Kane, noted nature photographer of Harvard, Mass. Using an Edgerton lamp and a 9 by 12-centimeter film-pack camera, Kane stopped the action of a common pickerel frog as it dived into a home aquarium in a darkened room. To prevent distortion of the image in the underwater shots, the aquarium was equipped with a plate-glass side. In every case, the amphibian made a natural dive; it was not pushed. All the exposures, showing the frog apparently floating in mid-air at the start of the leap and shooting through the water at the end of the dive, as well as hitting the surface, were made at the same speed—1/30,000 second.



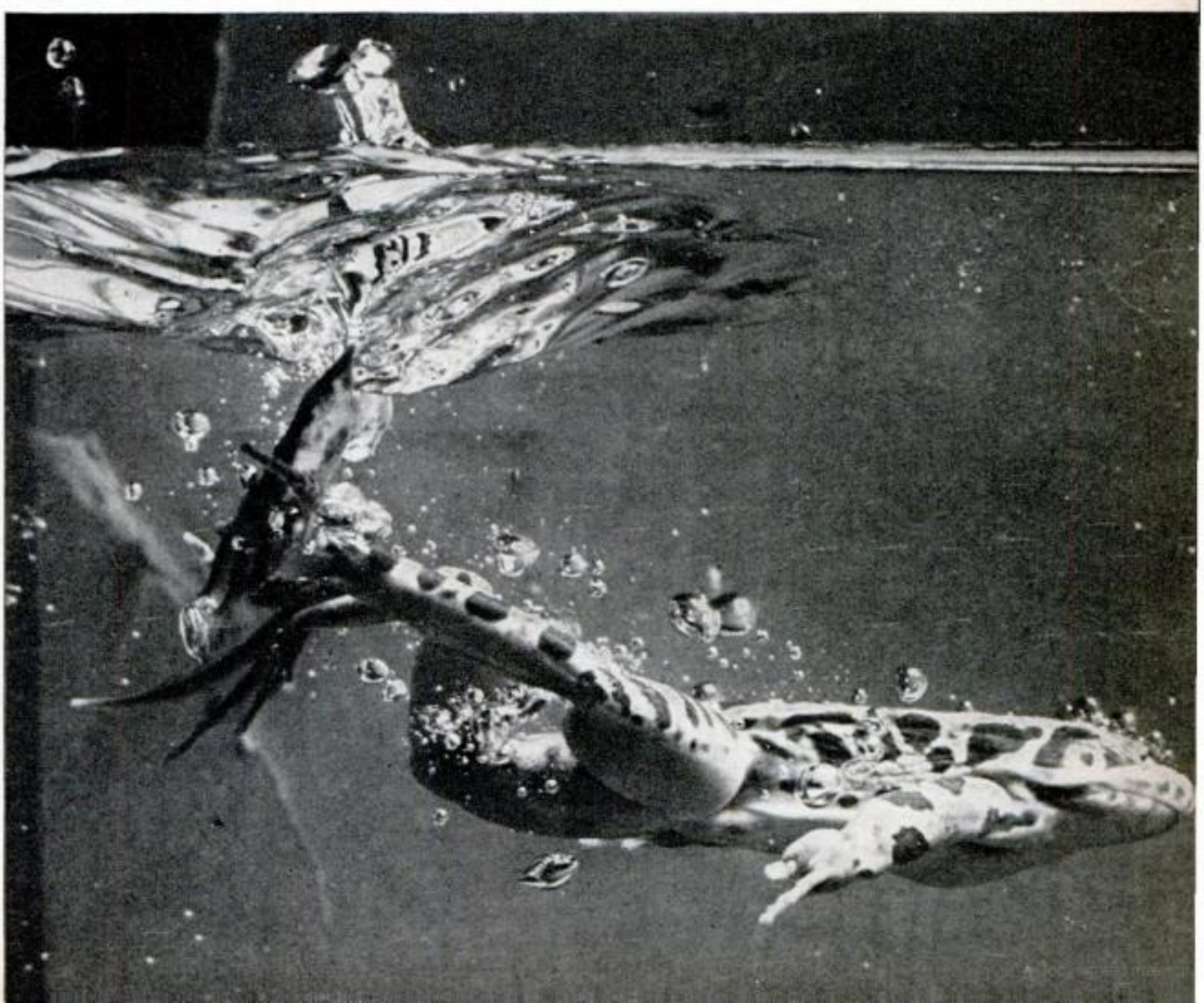
Oops! He hit it belly-whopper!



Now his legs are too far forward

You'd think that a frog would know how to dive, but these high-speed photographs, made with an Edgerton lamp, show technical errors that would rate a raspberry from the small boys at any swimming hole. The upper view illustrates the maneuver known as "knocking the pond dry." At the left, the diver's legs are held too far forward above his head

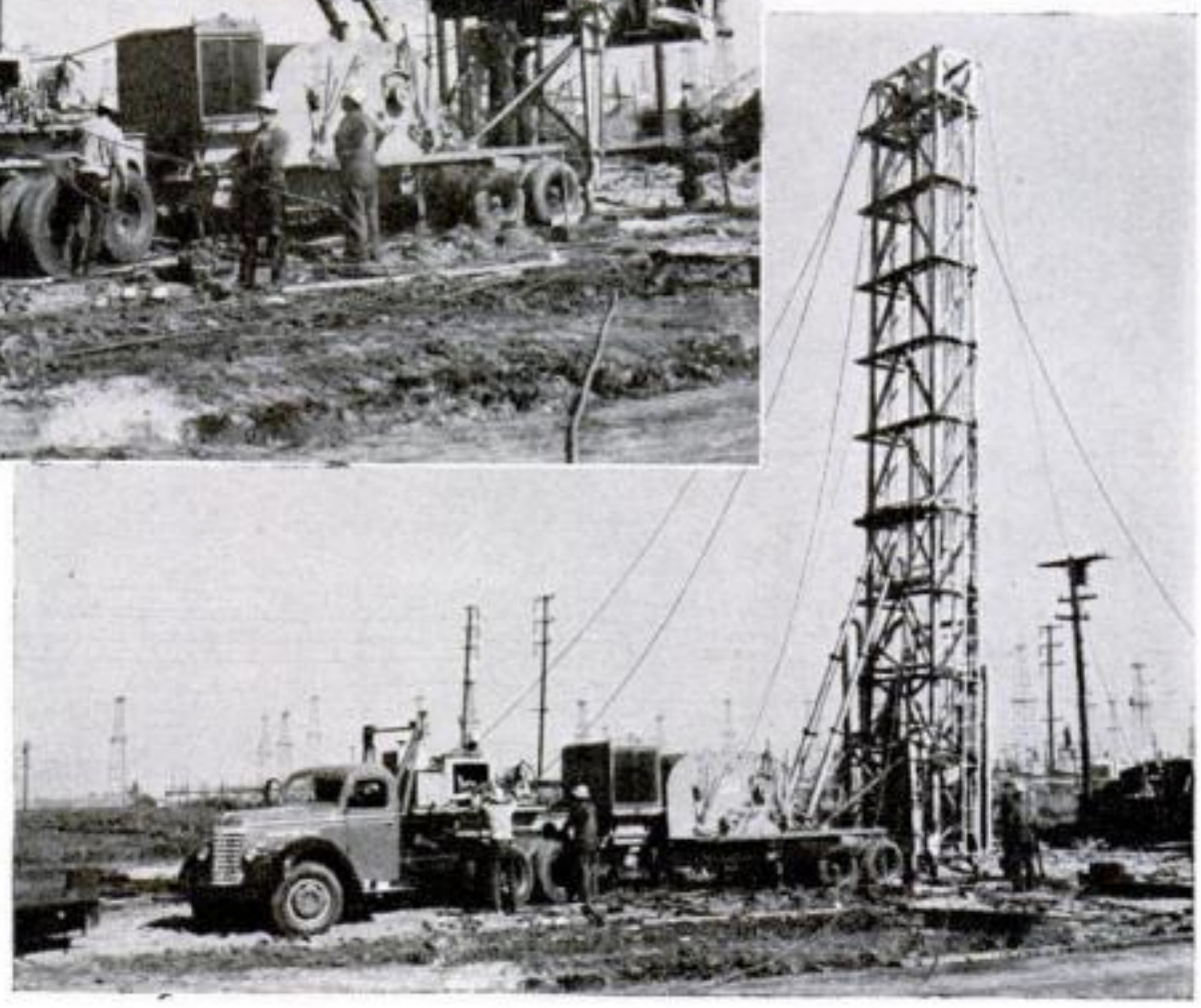
The start of a dive, with the frog's body apparently floating in air. All dives shown in these pictures were natural ones, made voluntarily by the frog without any prodding or pushing by the photographer. Below, the amphibian's body is gliding through the water after a successful dive



Mobile Rig Can Be Set Up at Oil-Well Site in Three Hours

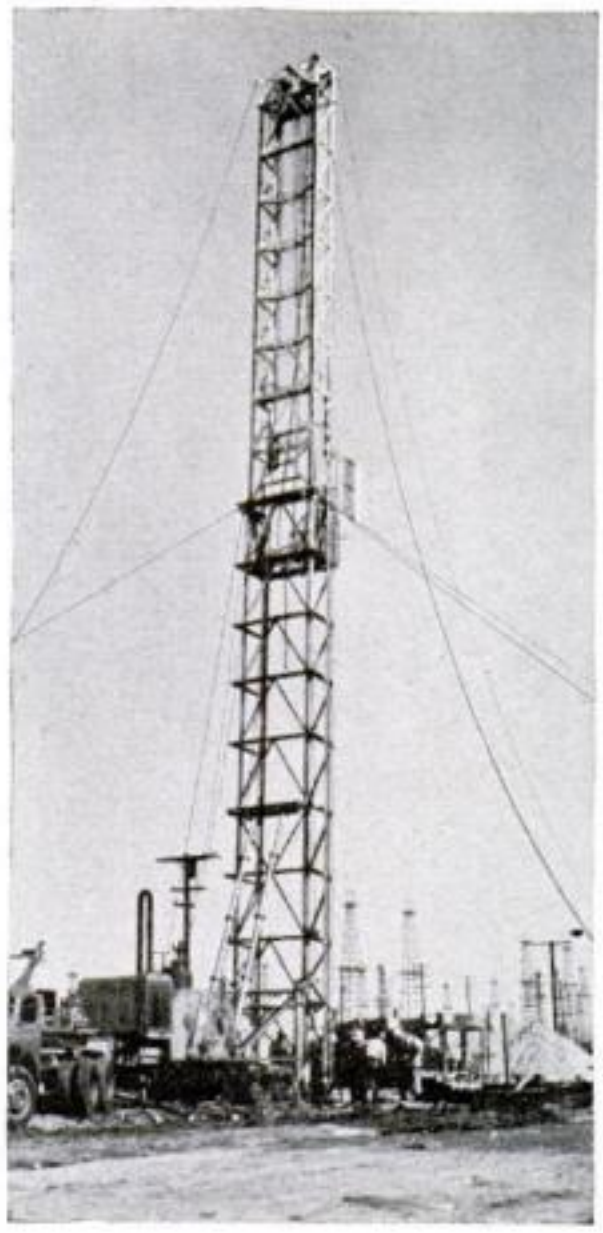
Built on a trailer, this rig can travel on highways without any special permit

Hydraulic jacks lift tower to half-height, and a separate winch raises it to 90 feet

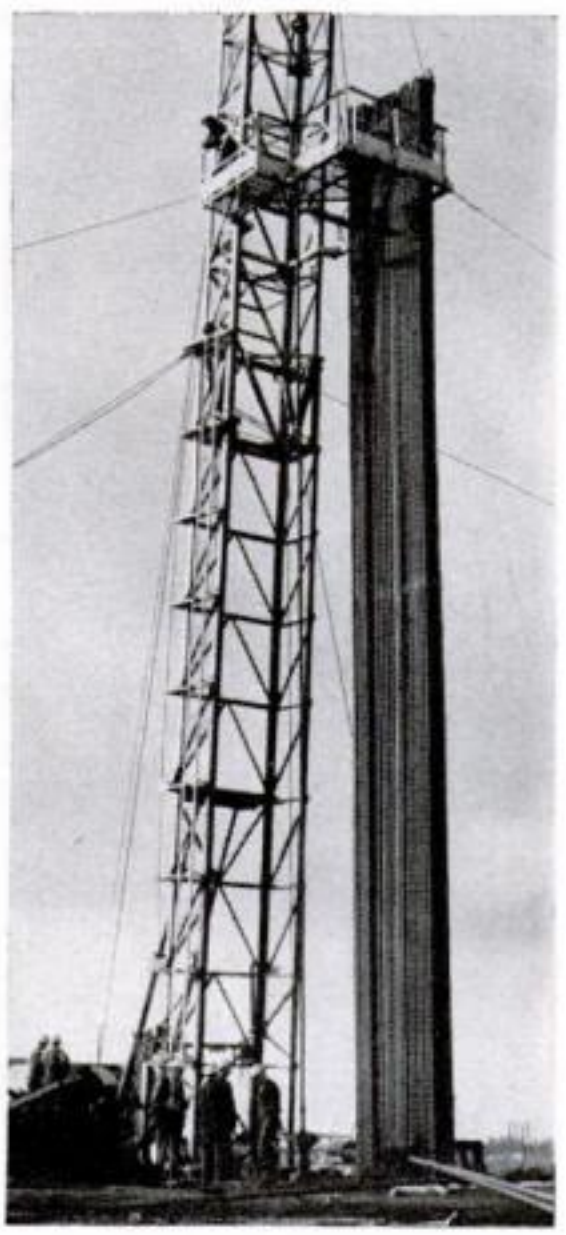


TO DRILL deep wells, three California manufacturers have developed a mobile rig which can be erected in three hours. It travels on its own trailer over highways without special permits. Hydraulic jacks lift the tower from the horizontal to half-height, then a separate winch line extends it up 90 feet. The rig can sustain 200,000 pounds, and rack 8,000 feet of three-inch or 10,000 feet of 2½-inch tubing.

Automatic latches, spirit-level indicators, and leveling screws enable operators to swing the device into action quickly. As the top section rises, latches engage stops welded to each outer leg. Thus, should the raising power or cable fail, the top section would fall only five feet six inches, the height of one panel. In lowering it, the latches are released from the ground.



The tubing block is carried in the tower and as soon as it is guyed, the mobile rig is ready to begin putting down the pipe

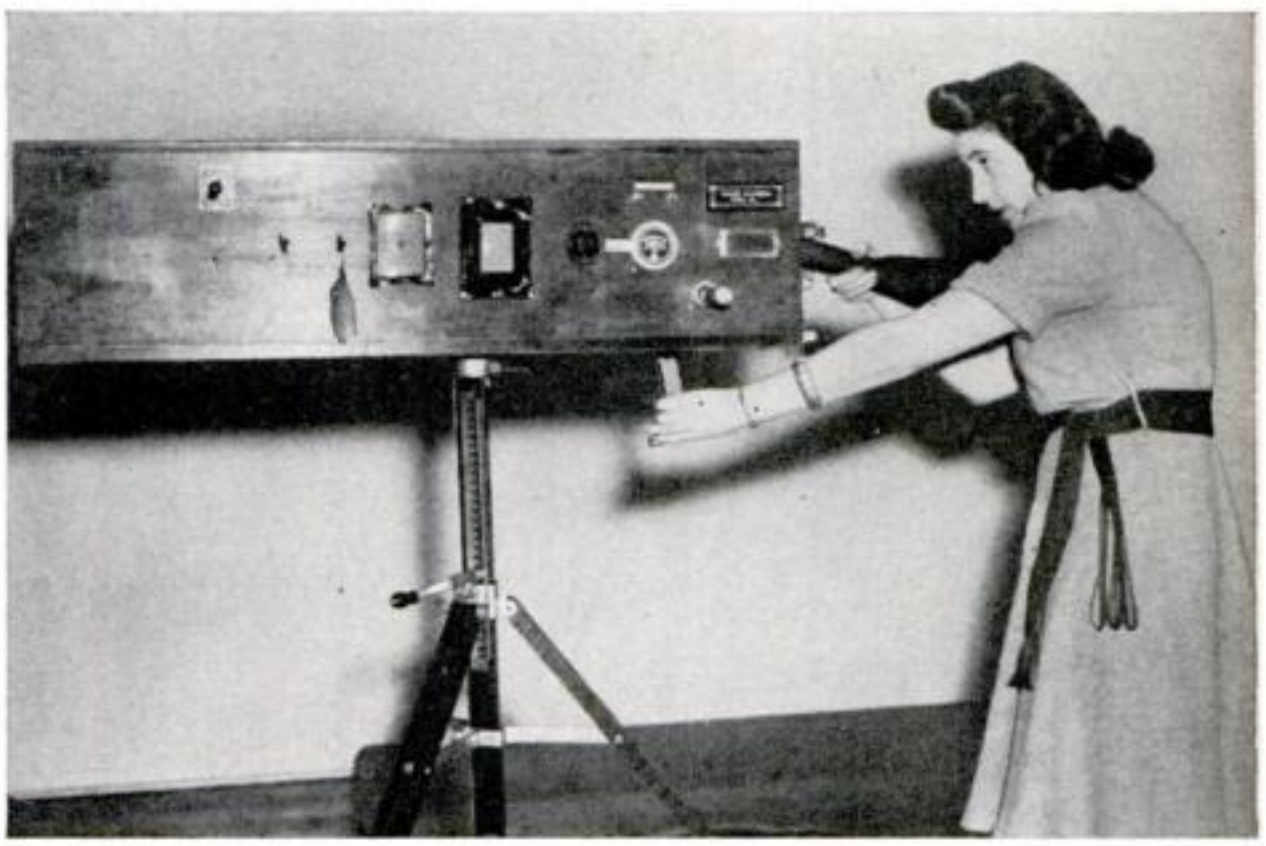


Pipe is lowered into the hole from outside the derrick. On its platform the rig has room for 2 miles of 2½-inch tubing

Rifle in a Box Trains Marksmen to Shoot —and They Don't Use Any Cartridges

TEACHING soldiers or civilians to shoot accurately in one tenth of the time usually required for the process is said to be possible with a device developed by Nathan P. Zablow, of New York, and Corporal Paul H. Fidelman, of the Organized Marine Corps Reserve. The apparatus consists of a box in which a rifle is placed, and which contains a miniature target and a series of gauges by which an instructor standing beside the box can tell when the rifleman is sighting his gun properly. Another set of instruments attached to the rifle trigger enables the instructor to tell whether the gunner is operating the trigger correctly. Faults in aiming and firing can thus be detected and corrected without actually firing any cartridges or checking target scores.

Nathan P. Zablow, one of the inventors, shows the works of the device for teaching shooting without gunpowder. The girl at the right demonstrates its use. Gauges check aim and trigger faults



Magnetic Gauge Measures Thickness of Metal Sheets

MEASURING the thickness of sheets of magnetic material even when only one side is accessible is possible with a gauge developed in the laboratories of the General Electric Company. Accurate to .001 inches, the gauge consists of a seven-pound indicating unit, which is connected to an electric-current outlet, and a cylindrical head containing an alnico magnet. Placing this head against the material measures its thickness in terms of the magnetic flux passing through the gauge-head circuit.

Magnetic flux in the gauge head indicates the thickness of the metal

Gas-Bag Fleet

NAVY COUNTS ON BLIMPS FOR PATROL AND CONVOY WORK

By JOHN WATSON

IN THE spectacular development of aeronautics under the compulsion of war and defense, public attention has been focused on the huge bombers and wasplike fighter and interceptor planes. These are instruments of battle and their movement is attended by tense and breathless drama. Little has been said of the lighter-than-air craft, yet the U. S. Navy—yes, and the Army, too—are going quietly ahead in experimental development of this phase of national defense.

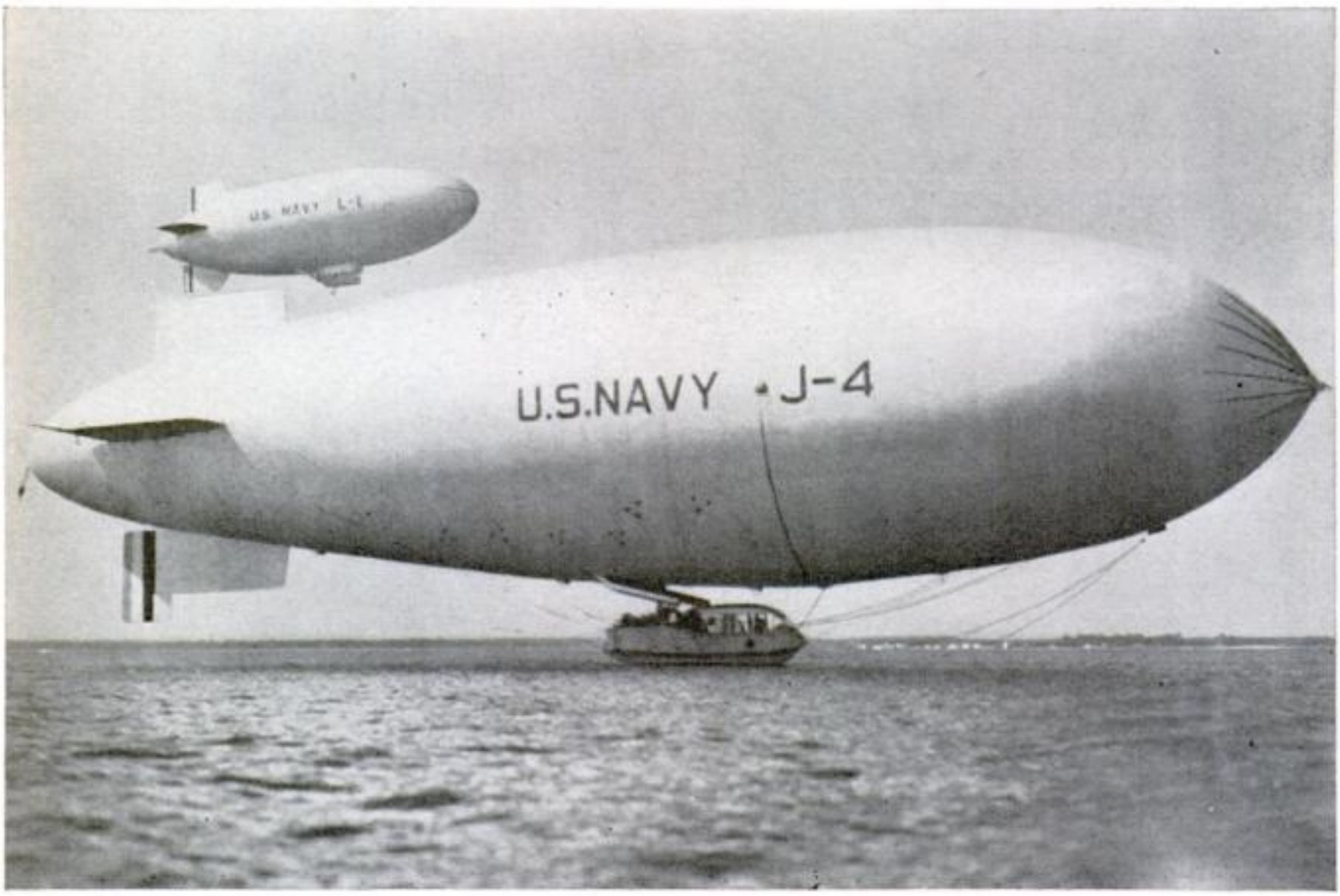
Nearly every morning, a great blimp rises in the dawn wind above the naval air station at Lakehurst, N. J., and heads out to sea across the curling rollers breaking on the New Jersey shore.

In the little cabin attached to the belly of the ship her two officers and six men move about their tasks with the efficiency that comes from long and meticulous training. All day long the ship remains over the sea, perhaps 100 or 200 miles out, or hugging the shore. Her speed ranges from 75 miles an hour—twice that of the fastest surface vessel—to zero.

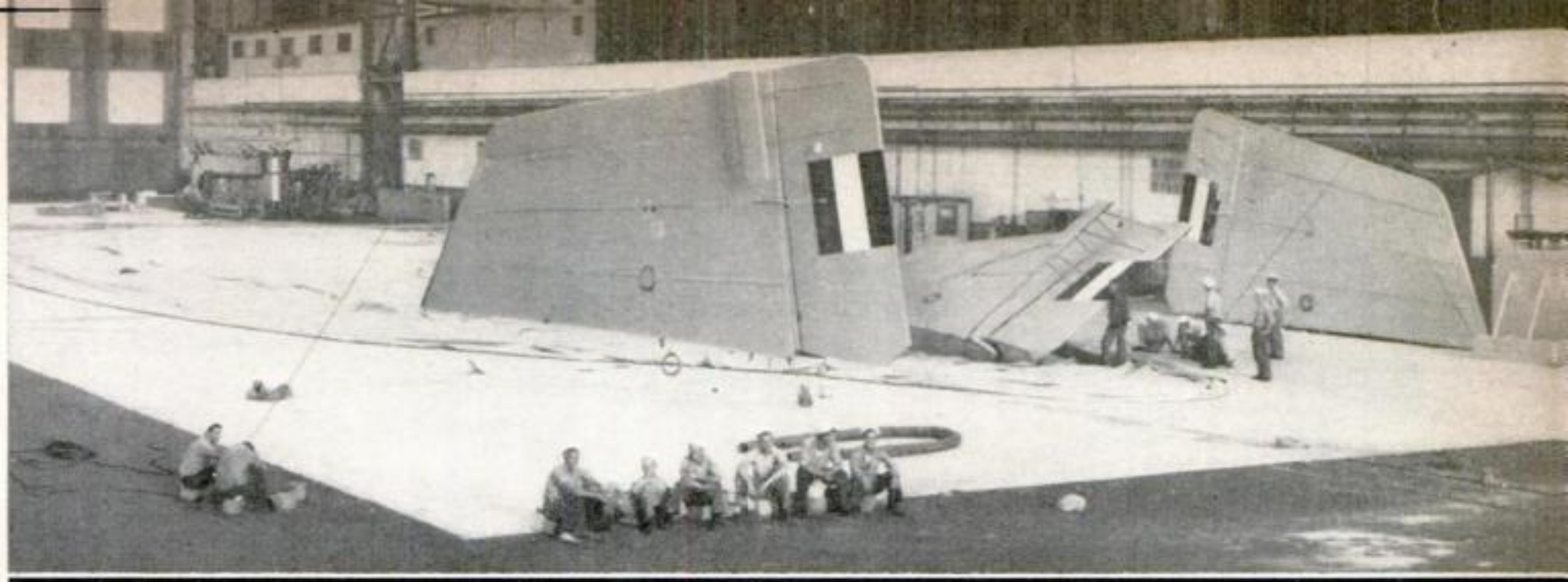
At the Lakehurst station, under Commander George H. Mills, training of officers and men is concentrated on nonrigid ships. There are three types of lighter-than-air ships: rigid, semirigid, and nonrigid. Rigid ships are the dirigibles—like the *Los Angeles,* recently scrapped, and the ill-fated *Shenandoah, Akron,* and *Macon*—in which the bag is built around a metallic framework.

Semirigid ships are those which have a certain amount of framework within the bag. The only ship which approaches this class in the U. S. Navy is the *ZMC-2.* It is 150 feet in length and has a gas capacity of 202,000 cubic feet.

Nonrigid ships, or blimps, have no internal structure at all. The shape of their bags is maintained by gas pressure alone, and for this reason they are often referred to as pressure ships. Ships of this nature at the Lakehurst hangar are the *K-1,* 220 feet long, gas capacity 320,000 cubic feet; the *K-2,* 250 feet long, gas capacity, 404,000 cubic feet; two "TO" ships, designed in 1930, 240 feet long, gas capacity 384,000 cubic feet; two "L" ships, *L-1* and *L-2,* 148 feet long, gas capacity, 123,000 feet; and the *G-1,* 187 feet long, gas



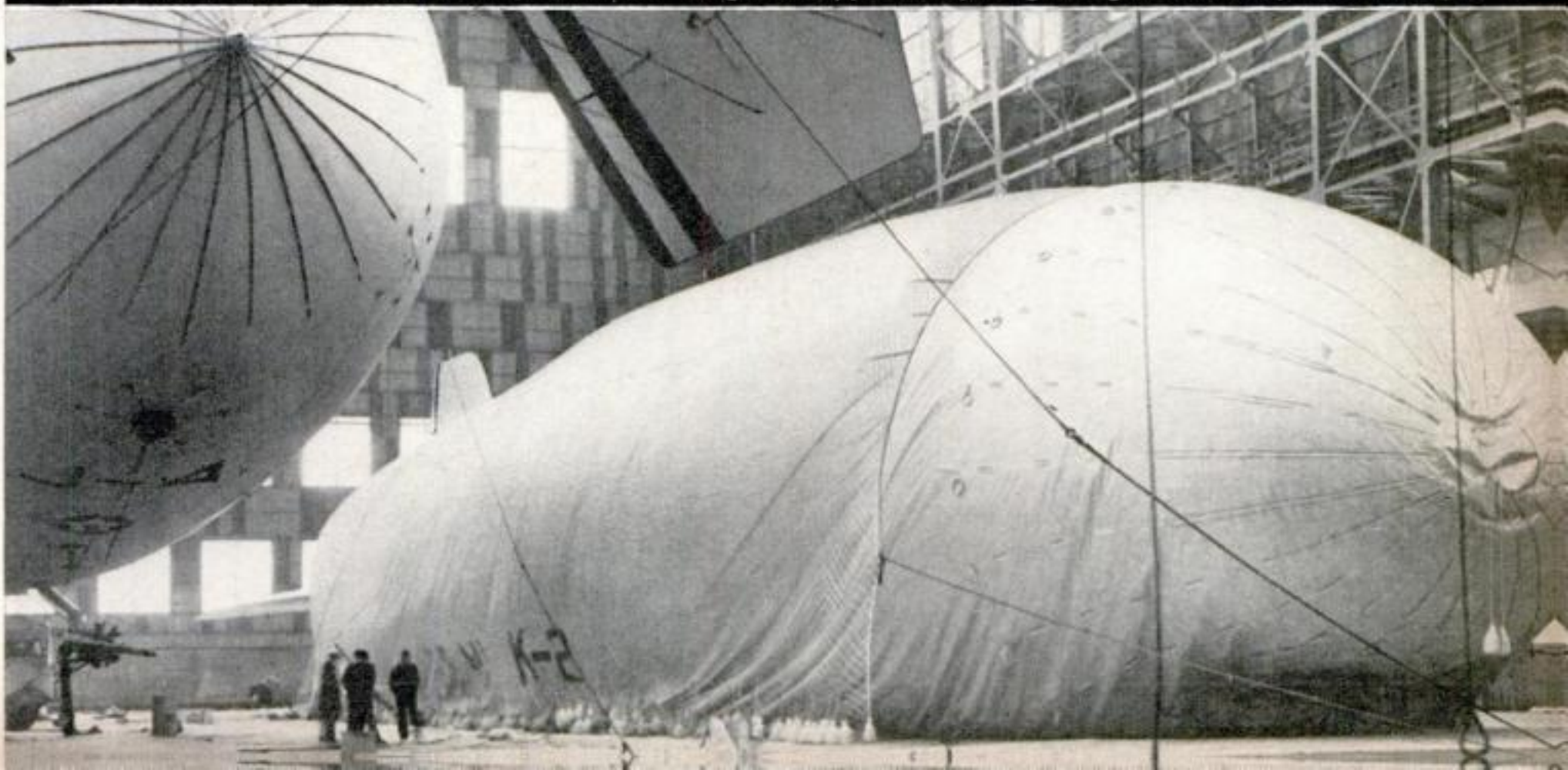
Navy blimps maneuvering at sea. Lighter-than-air craft are ideally suited for certain naval missions



In the Naval Air Station hangar at Lakehurst, N. J., the knocked-down blimp is ready for assembly. Parts come by truck from the manufacturer in Ohio. Here the bag is carefully laid out with the top rudder in its position

Before inflation begins, a net is spread over the huge bag and a fringe of sandbags is attached to insure uniform inflation. As gas is added, the sandbags are dropped lower on the net. The blimp begins to take shape . . .

. . . as inflation proceeds in carefully spaced stages. In the picture below, the upper vertical fin and the starboard horizontal fin are in place. Their weight is supported by slings hung from the top of the hangar



As the bag rises, the inflation line at the "tail" is lifted with it by means of a block and tackle hung from the hangar roof. Loss of helium is prevented by a heavy elastic band around the inflation sleeve. If it is necessary to inspect the inside of the bag, a man goes in with a gas mask

Bluejackets pick off "high-riding" sandbags from the net and attach them again at the floor level. This process must be continued throughout inflation, in order that strains may be distributed evenly as the huge gas envelope expands

capacity 183,000 feet. The *K-2* is regarded as the most efficient of these ships, and is the only modern one designed for patrol work.

An indication that lighter-than-air ships are destined to play an important part in the defense of America is the fact that the Navy has five ships on order, all nonrigid. Another is the $2,000,000 appropriation submitted to Congress for improvements at the Lakehurst station; including the building of two more hangars, crew barracks, quarters for bachelor officers, and a general service building to house the ground school.

Two things are confusing to a layman about lighter-than-air ships. What is their mission, he asks, and what of their high vulnerability? Commander Mills has answers to both these questions. He has served as an officer on battleships, heavy and light cruisers, and aircraft carriers, and he is soon to return to sea duty. He speaks, therefore, as a seasoned naval officer and not as a lighter-than-air fanatic.

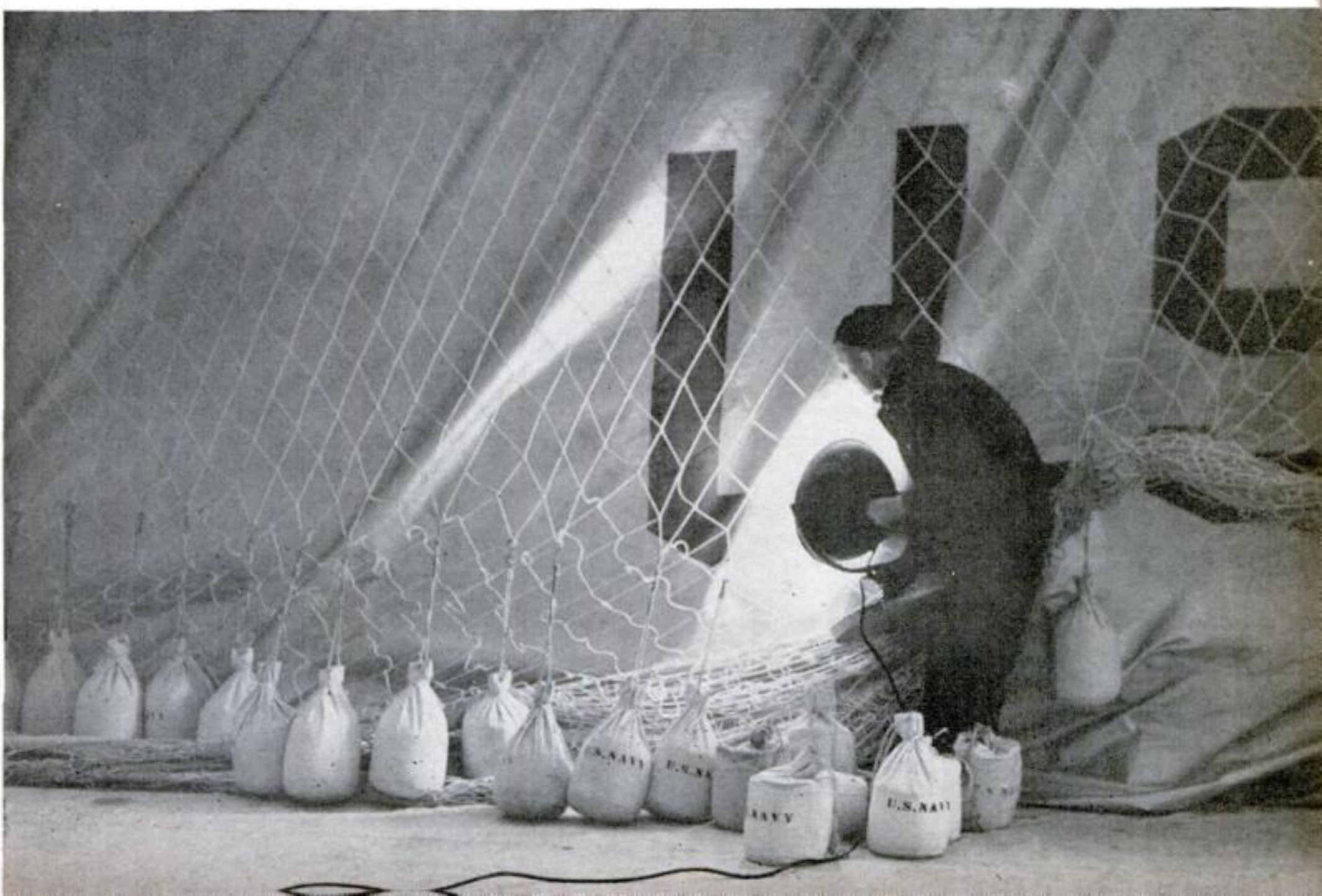
Because they can travel twice as fast as a surface vessel or can hover practically motionless over one spot, airships are particularly adapted to submarine search and depth-bomb attack, to convoy work, and to general coast patrol. Men in an airship can see farther and more clearly than men on a surface vessel. From an airship a submerged submarine can be spotted far more quickly than from a surface craft. From a surface vessel it is extremely difficult to sight a periscope in a moderate or heavy sea and fix its position. From an airship, the size of the waves makes no difference. Once a periscope is sighted, it can be kept in sight while the airship relays the position of the submarine to destroyers, or disposes of it by a couple of well-placed depth bombs.

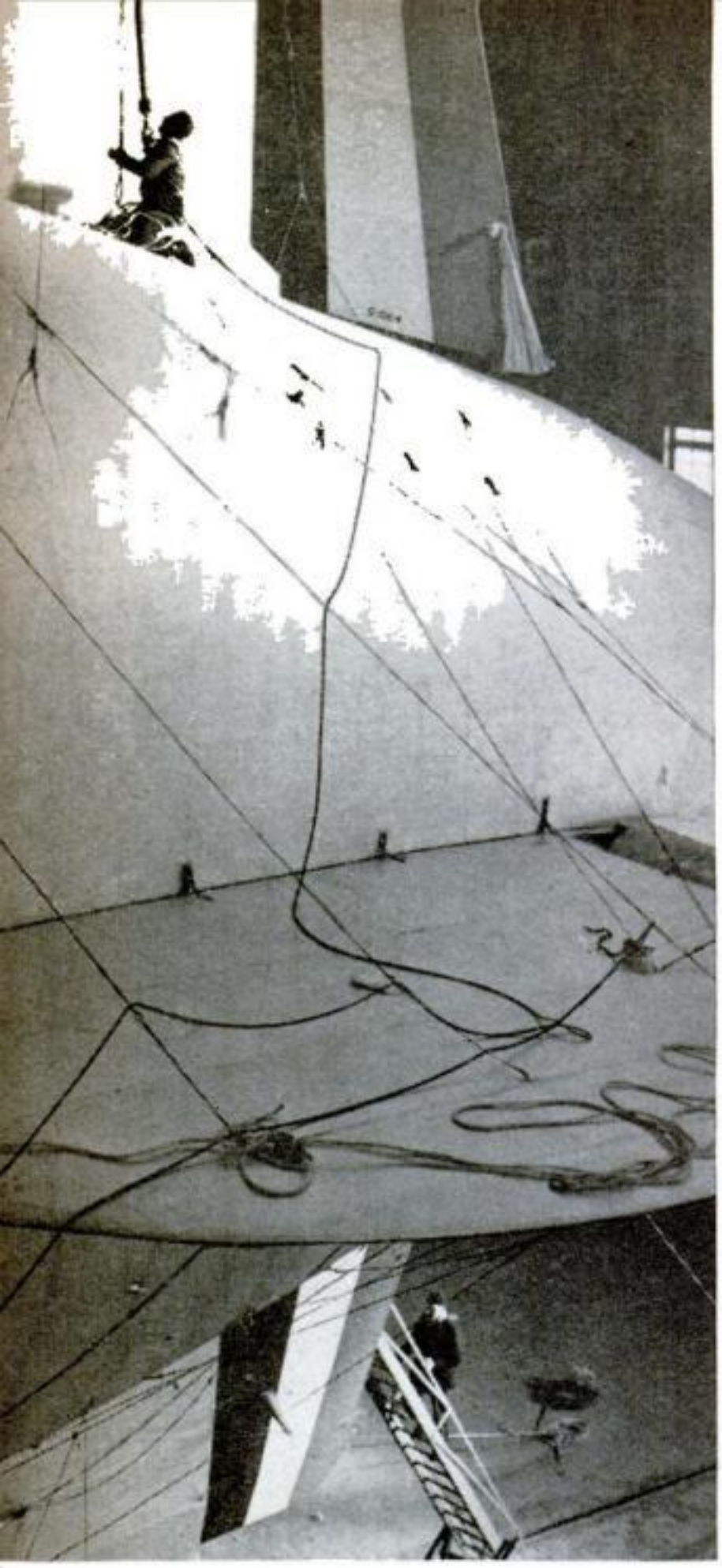
Lighter-than-air ships cannot be beaten for convoy work, in the belief of the men who serve them. Their greater speed, their much wider vision, their ability to stay motionless in the air make them superior to surface vessels. They can pick up a convoy 200 or more miles from the coast and escort it in to safe anchorage, shifting far ahead or behind to look for enemy planes or vessels, sending by radio the developments as they build up.

Remember that the smaller airships have a cruising range of 1,000 miles and the bigger ones, the dirigibles, have a cruising range of 4,000 miles. Furthermore, experiments undertaken with nonrigid ships show that they can take on fuel and water ballast while riding to a sea anchor. Or an airship can anchor in a quiet harbor, or otherwise protected waters, where fuel can be taken on.

Lighter-than-air ships are not nearly so vulnerable as most people believe, Commander Mills says. This is particularly true when they are inflated, as they are in

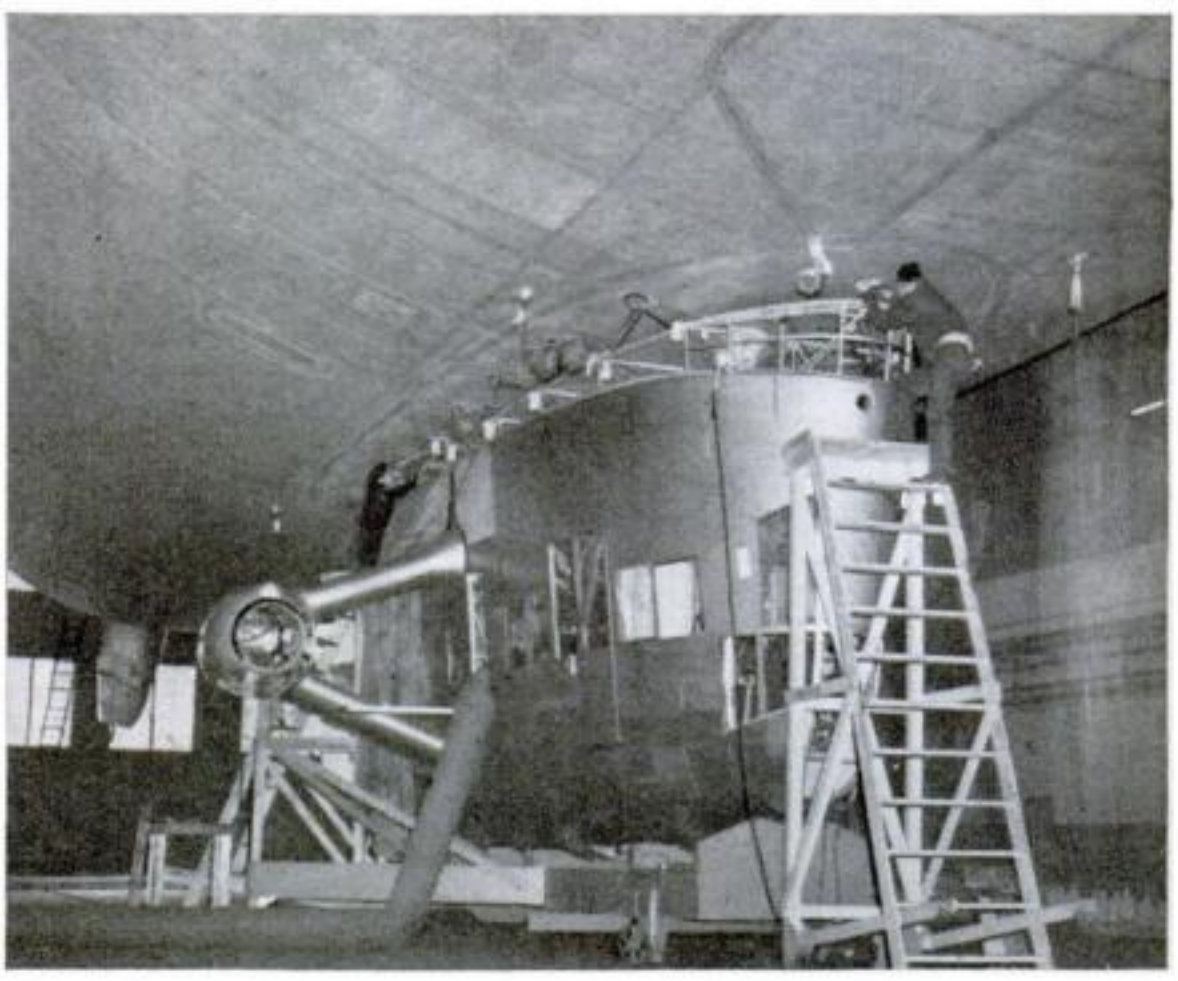
Testing the bag. If a man on the inside sees light coming through, there is a thin spot in the fabric





Now the finishing touches are put on the vertical fins. Men are sent up in bos'ns' chairs so they will not injure the fabric

While the vertical fins are being attended to, a man attaches the starboard horizontal fin to the bag with straps



With the bag almost fully inflated, the control car is fastened on its vertical supports, which go up through the envelope. Latest-type blimps carry five to seven men

this country, with helium gas which cannot be exploded or set on fire. Commander Mills doubts very much that .30 caliber machine-gun bullets, for example, could bring down a blimp, although it probably could be done by a plane equipped with cannon.

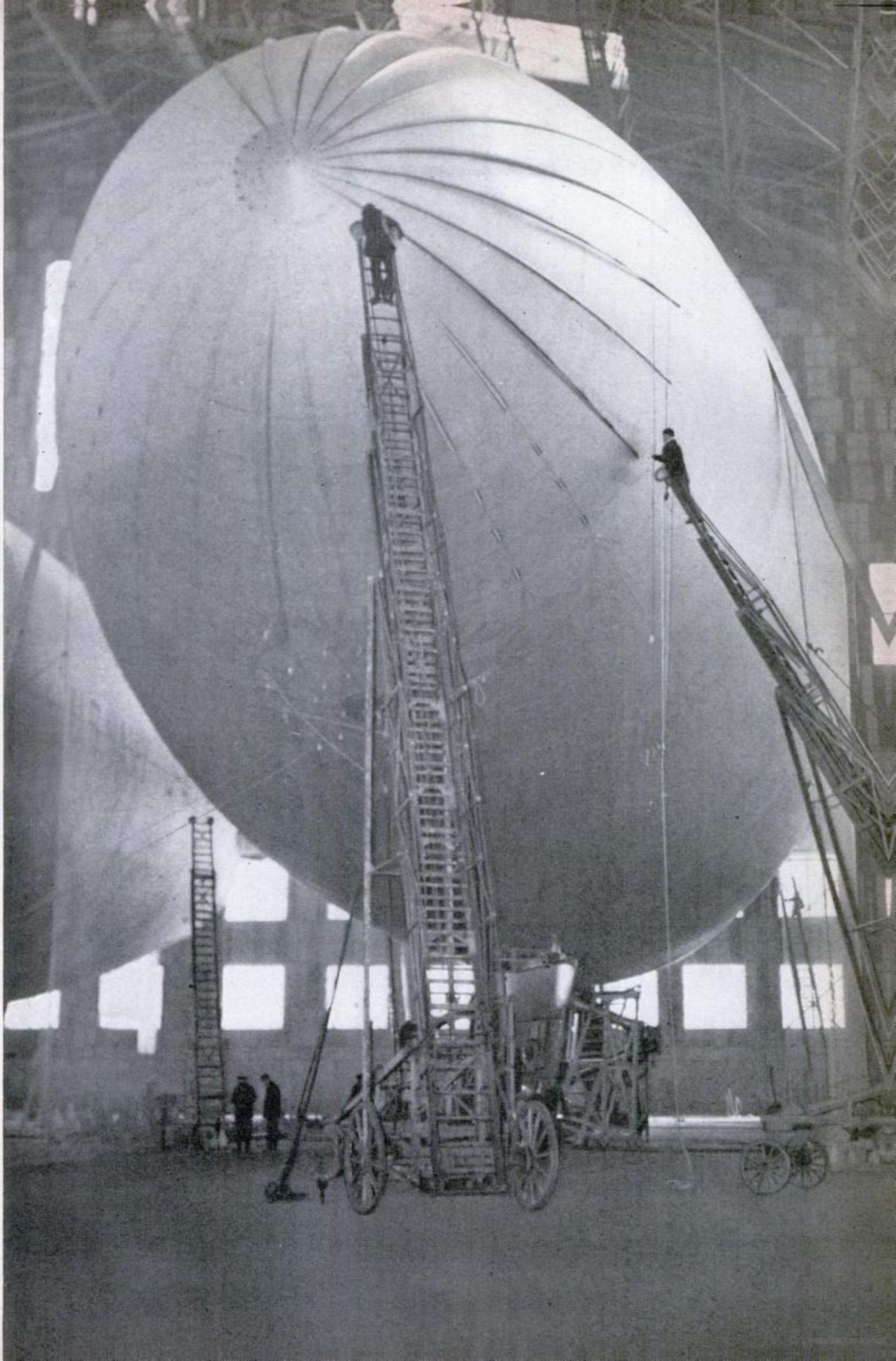
In the case of a dirigible, where the gas is separated into cells, it would be necessary for a shell to strike one of the steel girders of the framework to do any appreciable amount of damage. Unless such a direct hit were made, the only damage would be a clean hole through one of the gas pockets, and the ship could still stay afloat and get back to her home base.

Furthermore, a lighter-than-air ship is not intended to be used on a fighting line. Its particular mission of scouting and reconnaissance augmented by submarine search, convoy escort, and survey and protection of the shores would not be likely to place it in battle areas.

Blimps and dirigibles, of course, can also carry their own armament and would not be entirely helpless in an attack.

Although this country has no dirigibles in service now, men who are interested in lighter-than-air development are looking forward to the day when their worth will be more fully recognized.

Bow mooring plate and battens (to give the nose stiffness) complete the job. The process shown in the pictures took more than a month



Hand-Power Scythe Cuts Weeds Beneath the Water's Surface

A POWER SCYTHE has been developed which need not stop at the water line, but can continue out into a lake and thus mow down the ragged and prolific seaweeds, which heretofore have had to be cut by hand, if at all. It is light and easy to maneuver, and the one-horsepower motor is well up from the cutter to permit a considerable range from the shore. The blade is set 1½ inches above the ground, and it cuts a clean swath 34 inches wide. In addition to mowing seaweed, the scythe has many other cutting and trimming uses.

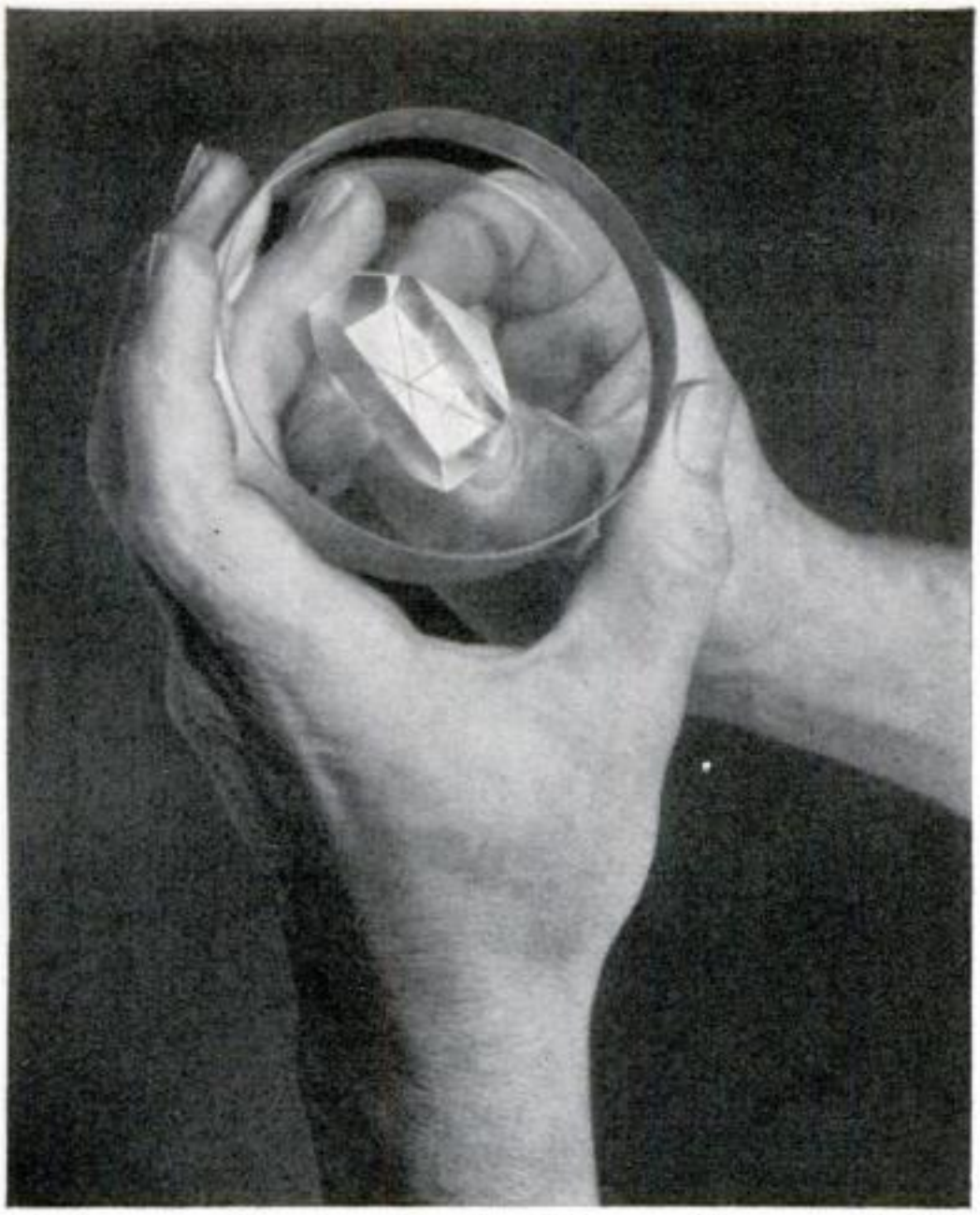
Even the most fastidious business woman will not mind wearing these transparent sleeve protectors

Sleeve Protectors of Pliofilm Are Strong, yet Inconspicuous

TRANSPARENT sleeve protectors of pliofilm have recently been introduced. They are noninflammable, waterproof, resistant to mild acid solutions, and unaffected by oil or grease, so they may be cleaned with a damp cloth and, say the makers, will last indefinitely. They are inconspicuous enough for office wear, yet strong enough for office men who must get their hands dirty now and then.

Cyclotron Turns Diamonds Green

THE cyclotron, or atom smasher, is being used at Harvard University to turn ordinary white diamonds into the highly prized green diamonds. Bombardment for an hour with heavy hydrogen atoms does it, and the gems retain their color better than the natural ones.



Testing a roof-angle prism for flatness with a quartz disk

Supply the Army with Its Telescopes, Range Finders, and Fire-Control Equipment

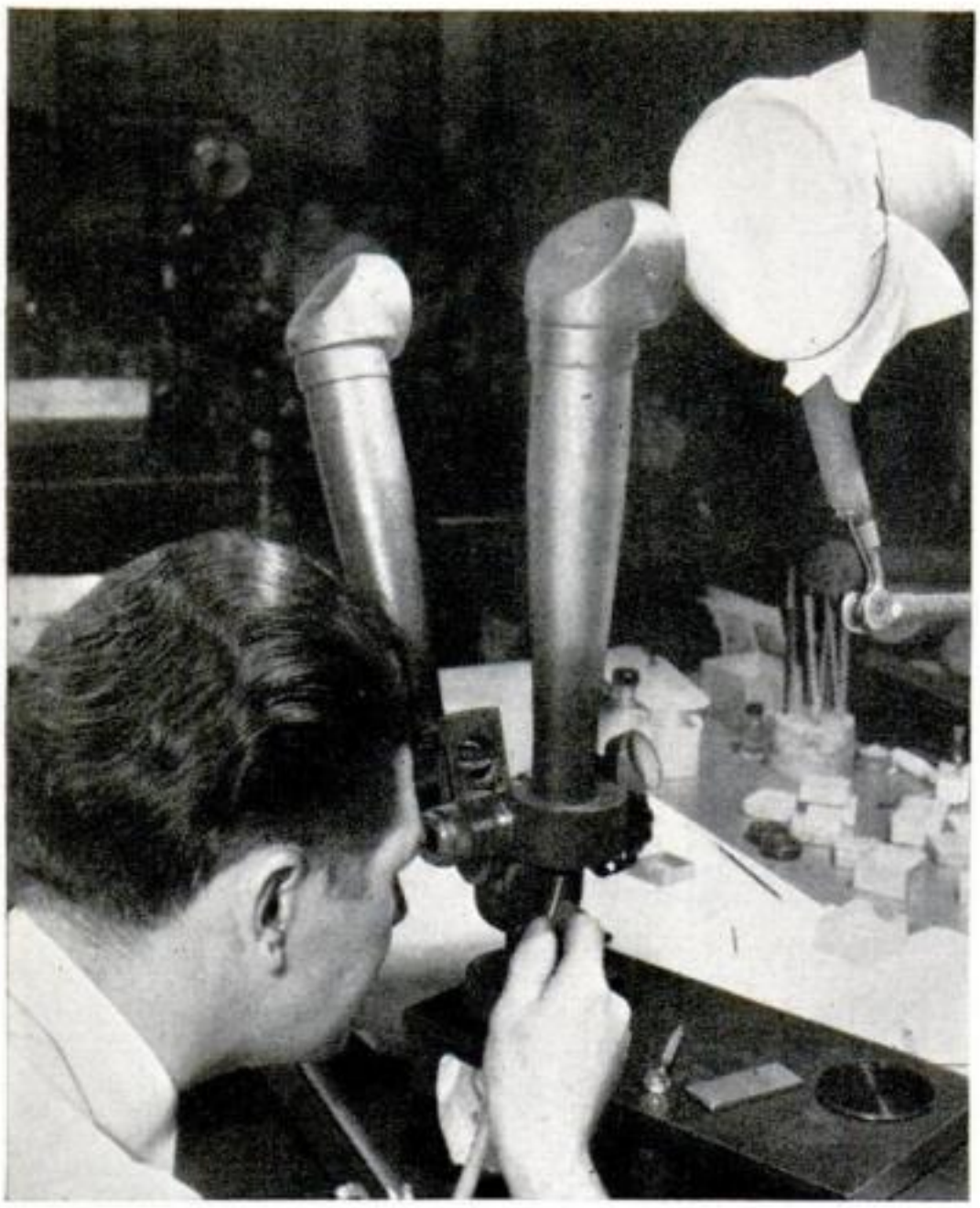
A SMALL group of handicraft workers, almost forgotten in the rush of mass-production industry, has suddenly become one of the most important elements in America's drive for national defense. They are the lens grinders who make the amazingly precise range finders, telescopes, and other instruments needed in modern war.

Tucked away as obscure civil-service workers in an Army arsenal, a handful of these men have maintained their art through the last three decades, and taught it to their sons. Today they form a small nucleus of hand skill and "know how," out of which America seeks to create a military optical industry to meet defense needs.

Lately they have been helping engineers of the National Defense Commission, seeking to transform this handicraft skill into high-speed production. In the past a lens grinder has been a man who knew his trade from the rough glass to the finished prism. By taking newcomers with a talent for precision work, and breaking them in to perform specialized jobs, production is being stepped up.

For generations, hardly anybody became

To check the critical angle of the prism, this worker looks through it at a target set up at right angles to his telescope. As long as the angle is not perfect, he sees the image double



Testing a battery commander's telescope. It contains reticles, or glass disks marked with fine sighting lines

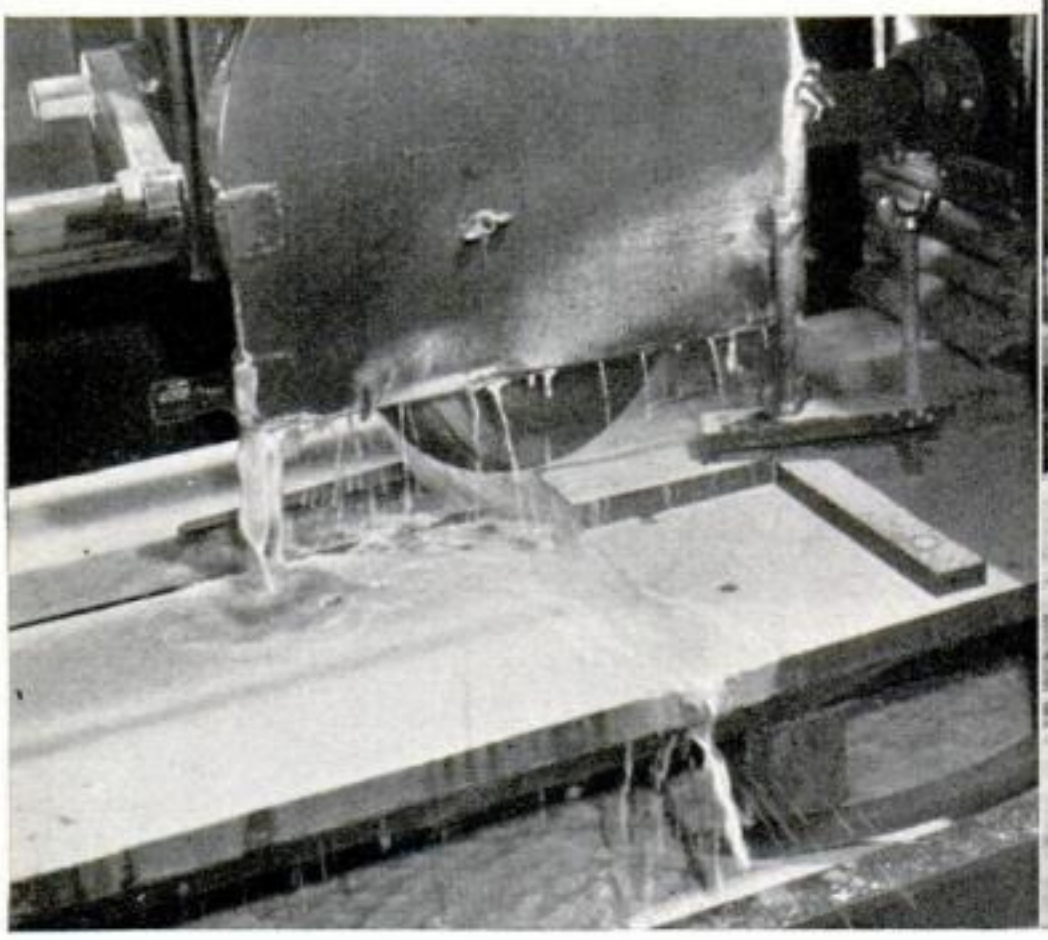
a lens grinder unless his father was a lens grinder. Germany was dominant in the optical field because it had the lens-grinding families and they maintained a sort of monopoly on the finest work by passing on the secrets of the craft only to their sons. They were so good that workmen elsewhere hardly dared enter the craft.

Back in 1908, when Army officers decided they needed an optical shop for Government service, they had a hard time persuading boys to learn the trade. The Army men hit on the idea of taking boys of German ancestry and giving them a high-pressure sales talk on optics. They got a few apprentices, and two of them are now foremen in the Government shops.

These two apprentices of 30 years ago not only learned the trade; they also carried its father-to-son tradition into their families. Both have sons adept at grinding prisms. One has a houseful of youngsters practicing on the glass-grinding wheel in the basement. By the time those kids are old enough, there will be jobs for them in private industry.

Private contractors handle the bulk of Government work. On the Army's own shop falls the responsibility of giving advice, and sending out skilled men to teach the tricks of the trade. It has also been their job to repair and adjust Army optical instru-

Blanks are cut out on a glass-cutting saw, an abrasive disk turning in a bath of emulsified oil. The girl at the right is marking reticle disks on baryta flint glass



ments, and to make experimental devices.

Before the first World War there were never more than a few workers in these shops. The number mushroomed to 89 craftsmen in 1917, and fell away again to a mere ten in 1928. After that it was built up gradually until there were 17 key men who really knew the job, and this has made rapid expansion possible. From a force of 40 last summer, it had expanded by midwinter to 140, and it was adding workers as fast as it could find men with the right kind of hands.

"It's a hand that counts," said the foreman, "just the same as with a ball player."

When people exclaim about the precision required of machine-tool makers, who work within tolerances of ten-thousandths of an inch, these lens grinders are not impressed. When a man makes a roof-angle prism, for instance, he is allowed no tolerance at all. This prism is used to take an image around a corner in binoculars, range finders, or panoramic sights. The critical angle of the prism has to be an absolutely perfect 90 degrees, or distorted vision results. And the final bit of accuracy rests entirely in the worker's fingers.

Prize example of the new technique of training apt pupils in specialties was a youngster who had been employed in the optical shop only five months, and was already correcting the critical angle on roof-angle prisms. But before that he had spent a year in a radio laboratory, learning to grind quartz crystals for transmitters.

"And in another month he'll be able to do the final job," said the foreman. "He's got good hands. And that's just what it takes."

Indeed it did take good hands. This boy was taking rough-ground prisms and working them down on a small, curved abrasive block, making measurements with a protractor. In grinding these little angles of glass, purely by precision of hand and eye, he was allowed a tolerance of two minutes in the angle of the prism. That meant that the surface, away from the angle, had to be accurate within .0002 inch. When they were polished and tested optically, only about ten percent came back for more work.

The final job, which the boy is probably doing by the time this gets in print, is even more accurate. On this day it was being handled by one of the veterans of the shop. Looking through a telescope into a prism, after it had been polished, he could see a reversed image of a target, set up 50 feet away, at right angles to his telescope. Every imperfection was magnified, and as long as the roof angle was not perfect, he saw a double image. Then he worked the prism down to perfection by rubbing it over a flat matrix of Norwegian pine pitch.

That also took good hands. But the prisms were so nearly finished when he got them that this superlatively skilled workman was able to put on the finishing touches at the rate of 40 a day.

The best reservoirs for new hands have been the radio industry's crystal grinders, and the amateur astronomers, who grind their own reflectors. But people with the right kind of hands may turn up anywhere. One applicant, who displayed a tiny, precise camera he had made for himself, was given a job quick. He was put to work in the room with the pantograph, making reticles—glass disks on which are etched the microscopic scales in an artillery telescope.

The story of this youth provides food for thought. He finished high school in 1937, and put in two years as an automobile mechanic, printer's devil, and newsstand clerk, before he found his niche in precision work. There must be thousands like him, doing rough work in which their sensitive hands and eyes are wasted.

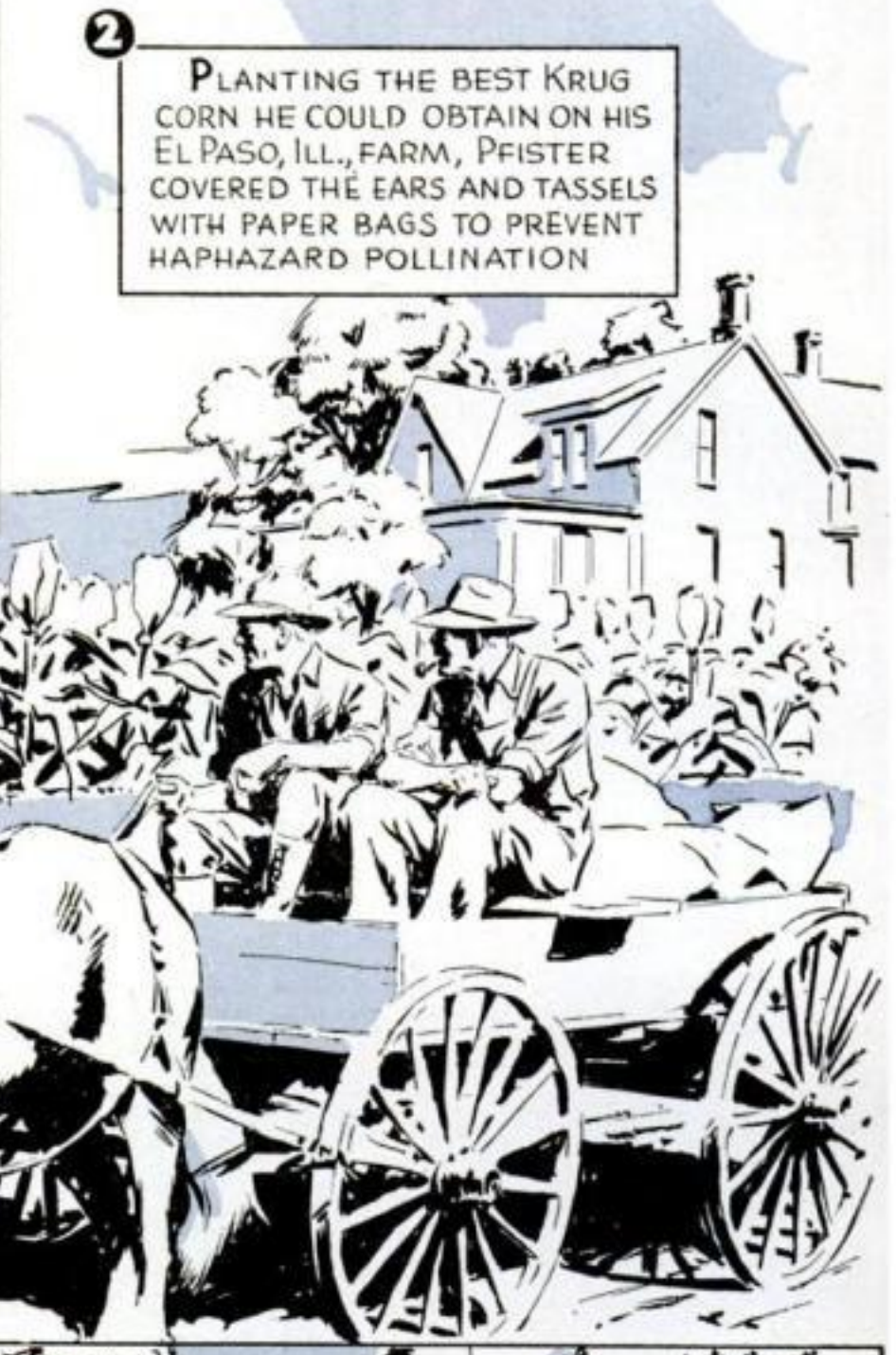
Modern warfare creates a tremendous demand for accurately made lenses, and if there are any boys working in newsstands now, with good hands and eyes, the Government has a use for them.

Raw material and finished products: A hunk of glass, with a few of the many kinds of prisms and lenses required for the precision tools of modern war

Here's My Story

1

AFTER A CONVERSATION IN 1925 WITH VICE PRESIDENT HENRY A. WALLACE, THEN EDITOR OF A FARM PAPER, LESTER PFISTER DETERMINED TO DEVELOP A BETTER BREED OF CORN



2

PLANTING THE BEST KRUG CORN HE COULD OBTAIN ON HIS EL PASO, ILL., FARM, PFISTER COVERED THE EARS AND TASSELS WITH PAPER BAGS TO PREVENT HAPHAZARD POLLINATION

3

FOR TEN YEARS HE TRANSFERRED POLLEN BY HAND TO SELECTED EARS TO PRODUCE NEW TYPES OF CORN. HE USED UP 100,000 PAPER BAGS IN 50,000 EXPERIMENTS

4

TO CONTINUE HIS EXPERIMENTS, WHICH KEPT HIM FROM HIS REGULAR FARM WORK, HE BORROWED UNTIL HE WAS $32,000 IN DEBT. HE EVEN SOLD HIS HOGS TO BUY PAPER BAGS

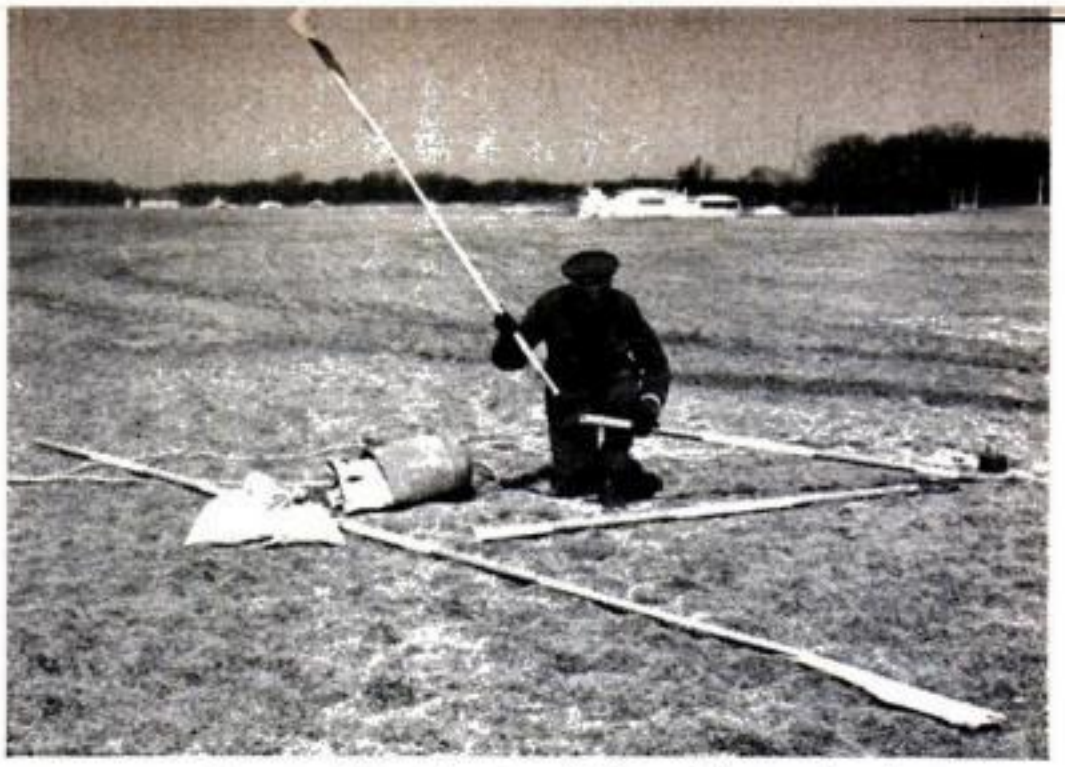
THE CAREER OF LESTER PFISTER

HE FORESTALLED A BANK FORECLOSURE ON HIS FARM BY SHOWING THE BANKERS HIS NEW CORN, WHICH WAS DROUGHT AND INSECT-RESISTANT, AND HAD MORE AND BIGGER KERNELS PER EAR

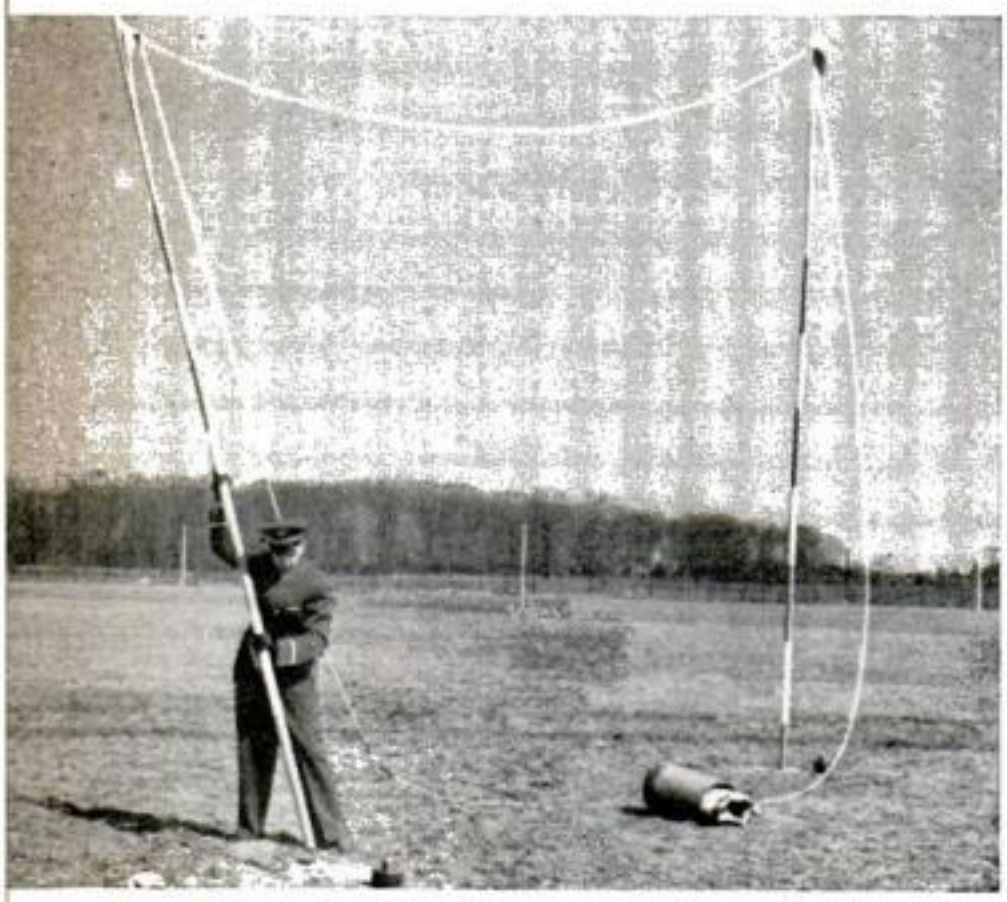
PFISTER'S PERSEVERANCE WAS REWARDED IN 1935, WHEN FARMERS REALIZED THE VALUE OF HIS PRODUCT AND BOUGHT $35,000 WORTH OF IT TO USE FOR SEED

PFISTER NOW HAS A PROFITABLE SEED BUSINESS AND THE SATISFACTION OF KNOWING THAT HIS CORN HAS PRODUCED FROM 6 TO 35 MORE BUSHELS PER ACRE FOR AMERICAN FARMERS THAN OTHER KINDS

An air-mail pick-up messenger removes station equipment from the locked box at the field . . .



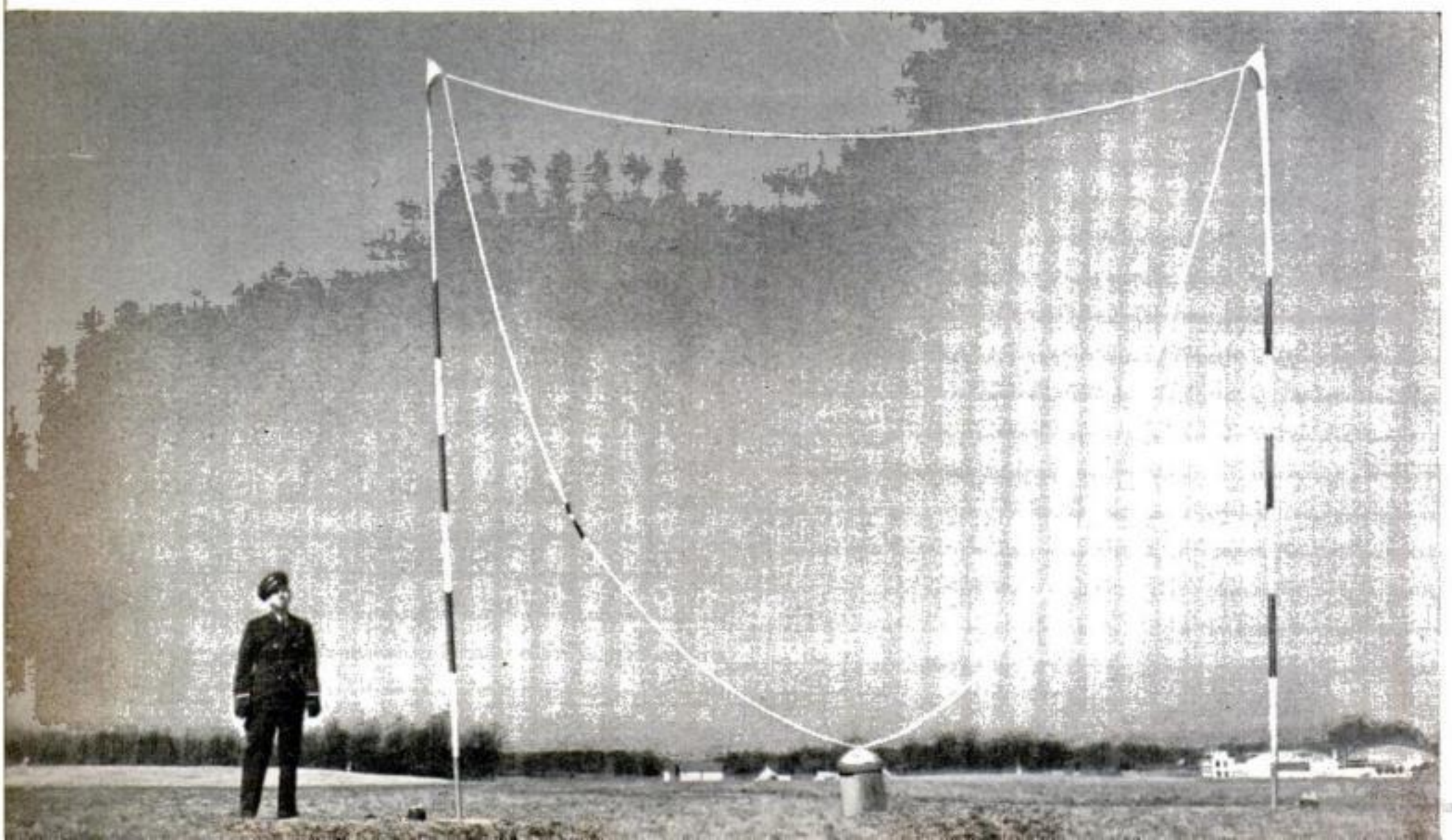
. . . and assembles the two lightweight poles that will support a rope loop for the plane to catch



After attaching the rope to the poles by spring clips, he plants them in sockets in the ground

Outgoing air mail is placed in the "bucket," a fiber-and-canvas receptacle padded against shock

With the container attached to the loop of rope, everything is ready for the mail plane's arrival



R. F. D. Gets Wings

Pick-up Service Brings Air Mail to Towns off the Main Sky Lanes

By CHARLES MORROW WILSON

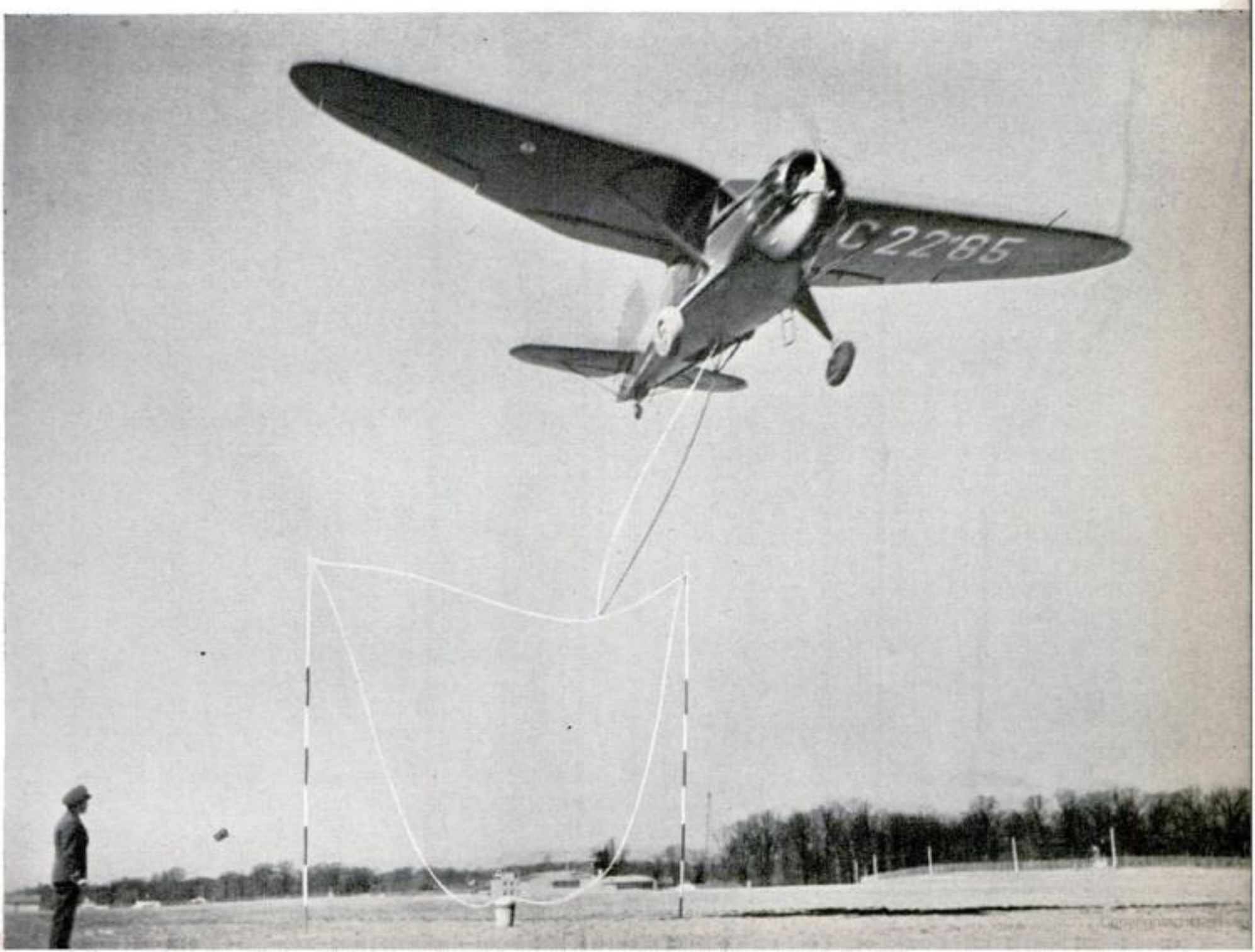
EFFICIENT plane service with a minimum of landings and ground costs is probably first among the new developments in aviation in which America leads the world.

Plane "pick-up" operation is now being proved a practical means for bringing air mail, air express, and other valuable aviation services to thousands of towns and communities. According to the Post Office Department we still have more than 4,000 cities and towns which have no direct air-mail service. A majority of these do not have airports. Yet their populations total more than half of all our people. Only 180 U. S. cities actually have air-mail delivery by passenger airliners. When air mail must be carried on the final lap of its journey by train or truck, the loss of time is serious.

Air-mail pick-up service is designed to bridge the gap between principal air-line cities and the thousands of off-line cities and towns, delivering air mail and other cargo to as many as a dozen towns within one hour of flying time without landing, maintaining a route speed of more than 100 miles per hour.

The pioneer in plane pick-up service is All American Aviation Inc., of Wilmington and Pittsburgh, which now operates six routes radiating from Pittsburgh to 108 cities and towns in Pennsylvania, West Virginia, Kentucky, Delaware, New York, and Ohio, for a total of 1,365 route miles. The routes are among the most difficult aircourses in the United States. The towns served are an average of 18 miles apart, though some are as close together as five miles. They range in size from 799 people to 120,000. The smallest, Glenville, W. Va., is thus the smallest in the nation with direct mail connection. Yet its 799 people dispatch an average of two to four pounds of air mail daily, which on a per capita basis exceeds even that of New York City, the greatest commercial-avia-

Swooping low over the field, the flying postman snags the loop with a hook and drops incoming mail



tion and air-mail center in the world.

The pick-up service makes two runs daily over all routes, collecting and discharging mail at each station. Since May 15, all the routes also carry air express. All American Aviation now flies the routes with eight single-motor Stinson SR-103 planes equipped with 260 - horsepower Lycoming motors. Richard C. du Pont, former national soaring champion, is president of the line.

Each pick-up plane is operated by a pilot and a pick-up man. The latter operates the equipment, sorts and drops the mail, and doubles as plane mechanic. Each plane is fitted with a mail bin of about 250-pound capacity, with additional storage space in the rear.

The pick-up man sits in a special seat near the loading hatch, which is an oval opening about two feet in diameter in the plane's belly. Equipment carried within the plane includes a hydraulic or electrically operated reel mounted upon a shock-absorber plunger cushioned by oil or air vacuum.

The ground equipment is even simpler. The pick-up station consists of two upright poles marked by flags and set 20 to 40 feet apart. The poles are usually painted in bright colors and at night or in dark weather are illuminated. The stations can be located in practically any open space with 1,000 feet or more of clear approach.

Mail is placed in small canvas dispatch bags specially designed by the Post Office Department. These are placed in the pick-up "bucket," a rounded, fiber-topped receptacle with heavily strapped canvas body and heavy rubber "skirts" to insulate it against shocks. The container is about 20 inches high, a foot in diameter, and holds an average load of about 30 pounds, though it can carry 50 pounds or more.

The container is swung to a loop of rope which is suspended between the tops of the poles by means of steel clips which release it upon sudden impact. The "messenger" or ground operator loads the container and sets the poles and the 60-foot loop for the pick-up.

In approaching a station, the pilot levels off his plane as if to make a landing, but maintains a speed of around 100 miles an hour and an altitude of about 30 feet. As he zooms toward the roped space between the poles, a cable with an eight-pound grapple hook is unreeled through the hatch. By pressing a hand trip on his instrument board the pilot next releases a rope loop which carries a container of mail for delivery. Thus the plane glides into the station trailing both the grapple cable and the delivery rope.

Just before making contact with the pick-up loop the pilot drops the delivery container. As the grapple hook snags the pick-up loop, the impact throws the reel into motion and the steel clamps free the loop. Thus the incoming cargo is drawn into the plane hatch as its tether rope is wound up on the drum of the reel.

Another pick-up device is a pole which folds against the bottom of the plane. For making pick-ups it is lowered into striking position with the pick-up hook at the lower end. When the arm strikes the transfer rope suspended between the two station poles, the impact disengages the hook from the arm and sets the reel into motion, thus raising the mail container into the plane.

If the plane misses its mark, which rarely happens, it circles and tries again. When more than one pick-up is to be made from the same station, the messenger or ground operator rigs the poles and delivery loops again while the plane circles and returns for the extra load. Should the cable become fouled by an object on the ground, a safety link placed beneath the plane's fuselage breaks, thus preventing injury.

Changes will be required with the use of larger planes, but All American Aviation engineers believe their present equipment could be used successfully by dual-engined planes capable of carrying a crew of two and from five to seven passengers and maintaining a cruising speed of 150 to 180 miles per hour.

Pick-up operation is far more economical than regular landings, since in addition to saving time it saves the extremely heavy strains upon engines caused by take-offs.

On a basis of payments by the Government to domestic carriers in 1940, the cost

Two men make a crew for the pick-up plane: the pilot, who must be a skilled and resourceful flyer, and . . .

of air-mail service is about 40 cents per capita per year for all people of the United States—by the present system of passenger-plane delivery of mail to cities along principal air routes. Total cost of operating the All American Airways pick-up system is reported as being 21 cents per year for each resident of the cities and towns served.

The unique pick-up line began experimentally in 1938 when Congress passed an act authorizing the Post Office Department to make a test of local transport of air mail. The "laboratory areas" included the mountainous and foggy terrains of western Pennsylvania and West Virginia which have long been regarded as the best air proving grounds of the United States. During the first year of experiment work All American pick-up planes flew 428,000 schedule miles, made 23,000 station pick-ups and deliveries and handled about 75,000 pounds of mail without damaging a letter or suffering a major wreck.

Pick-up routes of All American Aviation are being rapidly expanded. As speedily as equipment permits, air-express service is being added to the mail service. Serious consideration is being given to the possibility of passenger service over pick-up routes. The company also has two projected routes from New York into New England via Hartford and Boston terminals; also from New York City to Syracuse, Buffalo, and Harrisburg, and from Pittsburgh to Columbus, Cincinnati, and Buffalo. The completed system would eventually provide daily or twice-daily coverage of about 240 towns, total routes of 3,500 miles and direct service to approximately 5,000,000 people.

Similar applications waiting approval of the Civil Aeronautics Board include several probable new networks of mail pick-up routes. One seeks headquarters at Memphis for service to the Southwest. The Mercury Development Corporation of Indianapolis is applying for permission to establish seven pick-up air routes to serve as air-mail feeder lines to 135 towns and cities in Indiana, Illinois, Michigan, Tennessee, Missouri, Ohio, and Kentucky. The total route length proposed is 2,680 miles, which would bring direct air-mail service to about 3,000,000 people who do not receive it at present. The line proposes to use nine DGA-15-JC Howard planes with Jacob model 330-horsepower engines with a pick-up speed of 130 miles per hour. The application suggests that other equipment and services contemplated by the line will be similar to those of All American Aviation.

This equipment would include miniature parachutes for flight delivery of fragile or breakable goods. All American Aviation has adopted a 10-foot-diameter parachute which is packed in a metal tube about 15 inches long and three inches in diameter.

Meanwhile pick-up flying proves itself rich in human details. Pilots must be exceptionally skillful and of adventurous temperaments. Pick-up men fill what are probably the most exacting jobs in modern aviation, for they must be versatile mechanics, emergency pilots, expert mail clerks, and at times first-class acrobats.

Recently, a station pole was accidentally broken at a West Virginia pick-up "spot." The ground messenger held up one end of the delivery rope by hand while the plane made a perfect pick-up.

The trade takes a new and dramatic role in civil aviation. It points to a time when all first-class mail, local mail excepted, may be carried by plane without extra cost to you and me.

. . . the pick-up man, pictured here beside the mail hatch and the reel for hoisting containers

At the home airport, mail is removed from the plane for delivery or transfer to big airliners

Industry's $100,000,000 TOOL

Abrasives are the Key to the Machine Age

By WALTER HOLBROOK

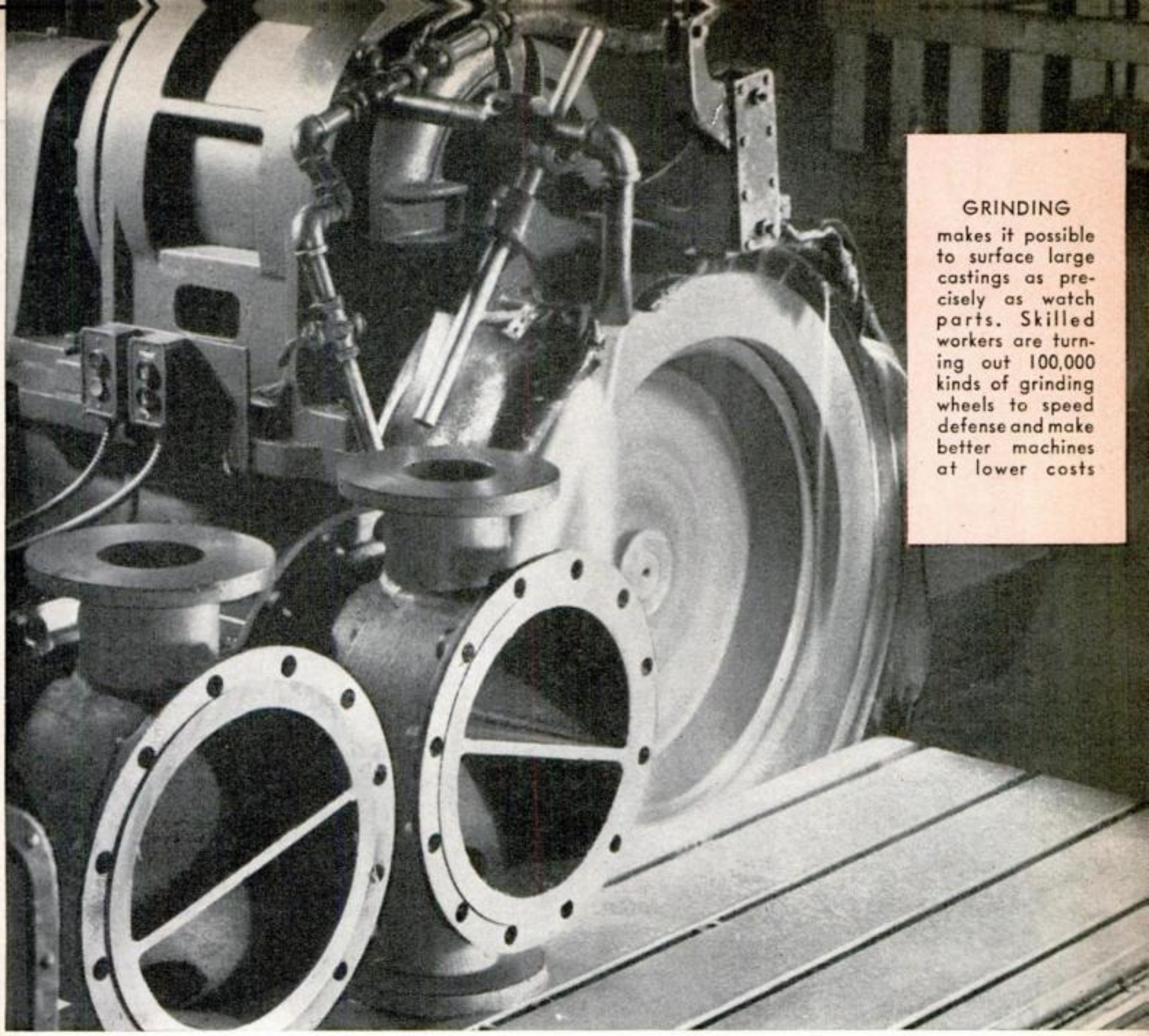
WHEN the second World War began there were fewer than 10,000 men in the United States making abrasives, without which not a single airplane, gun, ship, or truck could have been built. Today nearly twice that number labor overtime turning out 100,000 different kinds of grinding wheels, each to fill a special need, and the head of the Norton Company appeals to his employees at Worcester, Mass.: "We need more skilled mechanics who are not doing armament work elsewhere. If you know of any, tell the employment department." One division of this company, which, with the Carborundum Company, divides half the nation's abrasive business, is producing three times what was figured as its capacity a year ago, and a recent study indicates it can do four times normal capacity, thanks to a policy of rebuilding the plant in dull times. At Washington sit six grinding experts trying to anticipate every possible abrasive requirement in the nation's "all-out" effort.

Grinding is as old as the Stone Age and as new as the latest gadget. Ten-ton grinding wheels pulverized logs to make the newspaper you read this morning, other wheels ground wheat into flour for your toast, and an abrasive cylinder only twice as thick as a human hair slit the point of your fountain pen. Grinding made possible the car you drive and almost any object you can name.

Ever since the first cave man shaped and sharpened his stone ax by rubbing it on another rock, man has chased perfection in grinding. Today he strives for an absolute smoothness of surface so that the working parts in all his ingenious machines will fit perfectly, and not wear out.

Only a year or so ago airplane engines had to be torn down after running 200 hours. Now, to the amazement even of British and German engineers, the best American motors run 1,000 hours without having to be overhauled. Behind that long step toward perfection is an improved grinding wheel, which will cut the toughest alloy to within 1/25,000 of an inch, and, by selective assembly, make it possible to fit a piston accurately to within plus 1/25,000 of an inch into a cylinder accurate to within minus 1/25,000 of an inch.

Research workers are now humping themselves to scratch up formulas to achieve



GRINDING makes it possible to surface large castings as precisely as watch parts. Skilled workers are turning out 100,000 kinds of grinding wheels to speed defense and make better machines at lower costs

accuracy of 1/30,000 or even 1/50,000 of an inch, to cut costs and at the same time give production the hot-foot. They've made production jump and saved money doing it many times. They're staying up nights to do it again.

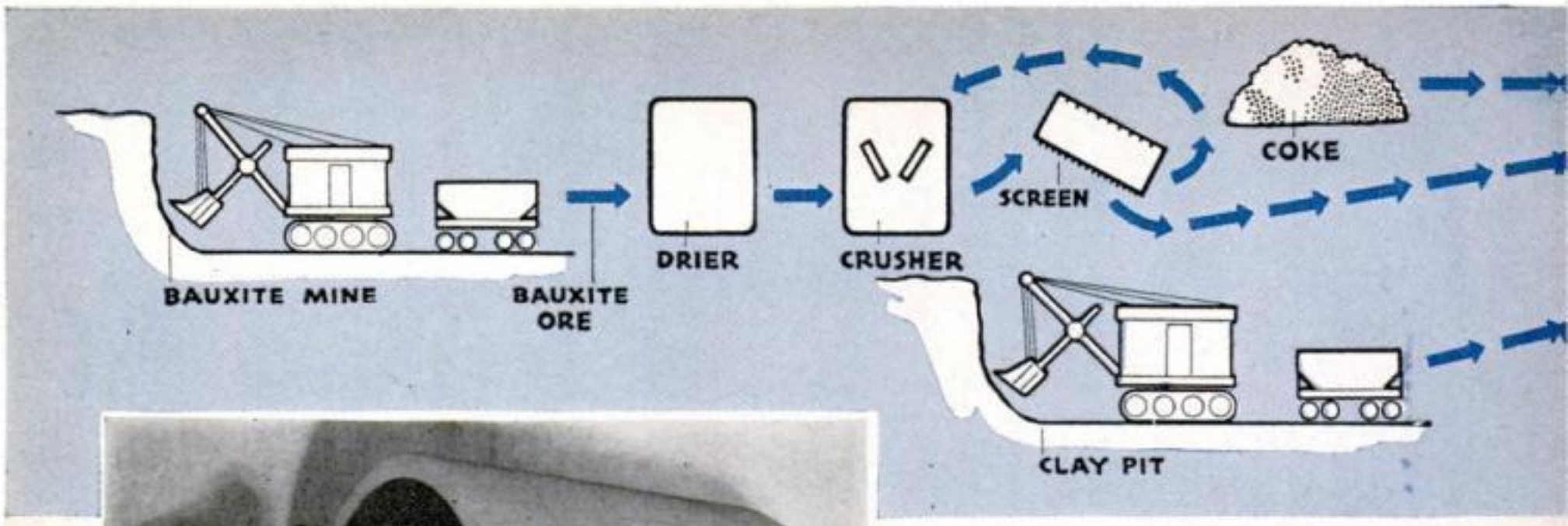
Practically they have only a dozen or so materials to work on. A grinding wheel is made of grains of diamond, silicon carbide, aluminum oxide, or boron carbide held together by glass, shellac, resinoid plastic, rubber, metal, or other binding material. By using different abrasives and bonds, different grains and shapes, research engineers devise the most efficient wheel for each use.

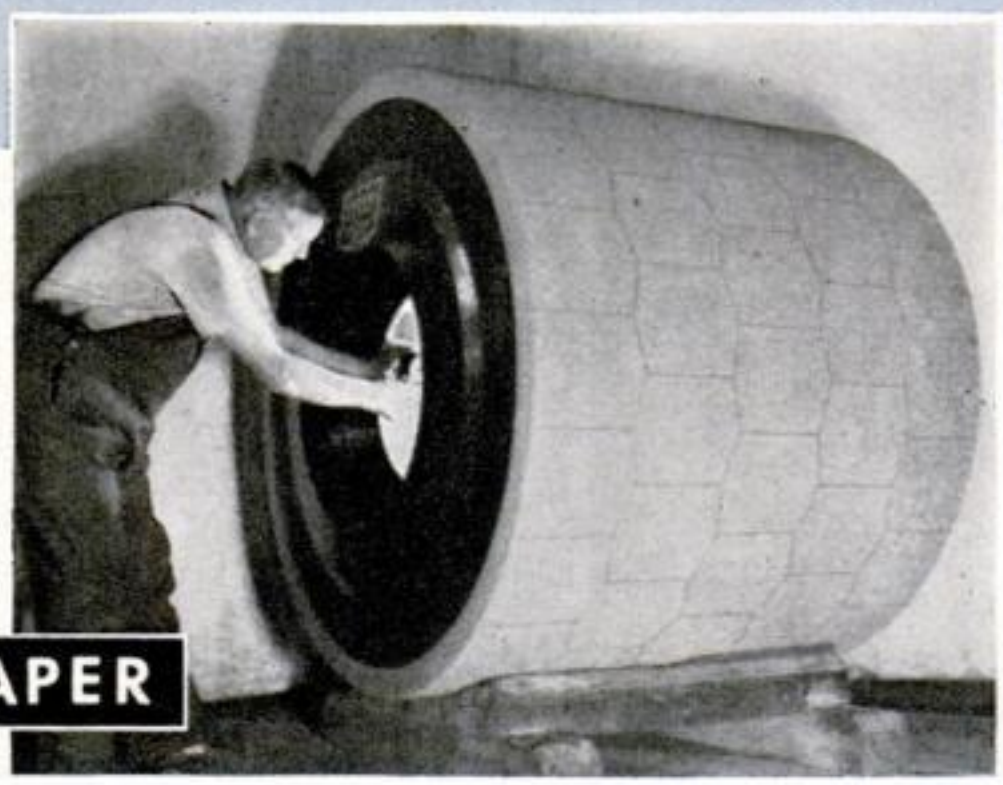
Less than a dozen years ago the cemented carbide tool was produced to speed up the cutting of the toughest steel and aluminum alloys. Silicon carbide would sharpen this fast-cutting tool, but existing grinding wheels tended to overheat and crack the sensitive carbide tip. Wheels were made soft to avoid this. They wore out quickly, so the research engineers developed the resinoid-bonded diamond wheel. Fast and cool-cutting, it is in no small measure responsible for the wide use of cemented carbide tools.

Now a metal-bonded diamond wheel has been developed to sharpen carbide-tipped single-point tools. A wheel with only 1/64 of an inch of diamond in the rim will outlast several resinoid-bonded diamond wheels and that means lower wheel cost per tool ground. For some machine grinding, a metal bond is too hard, so the research engineers are hunting for still another binder.

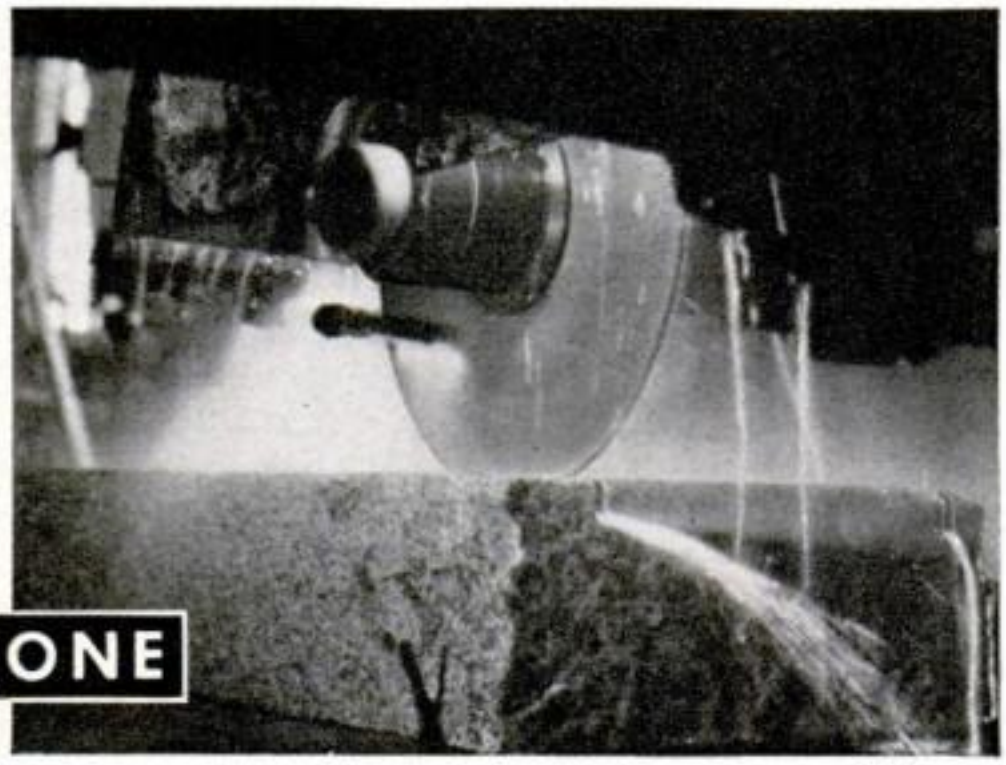
Diamond dust was used by the ancients to polish precious stones, but mass production is based largely on two artificial abrasives which fifty years ago did not exist: silicon carbide and aluminum oxide. Both were American discoveries.

Eli Whitney, the inventor of the cotton



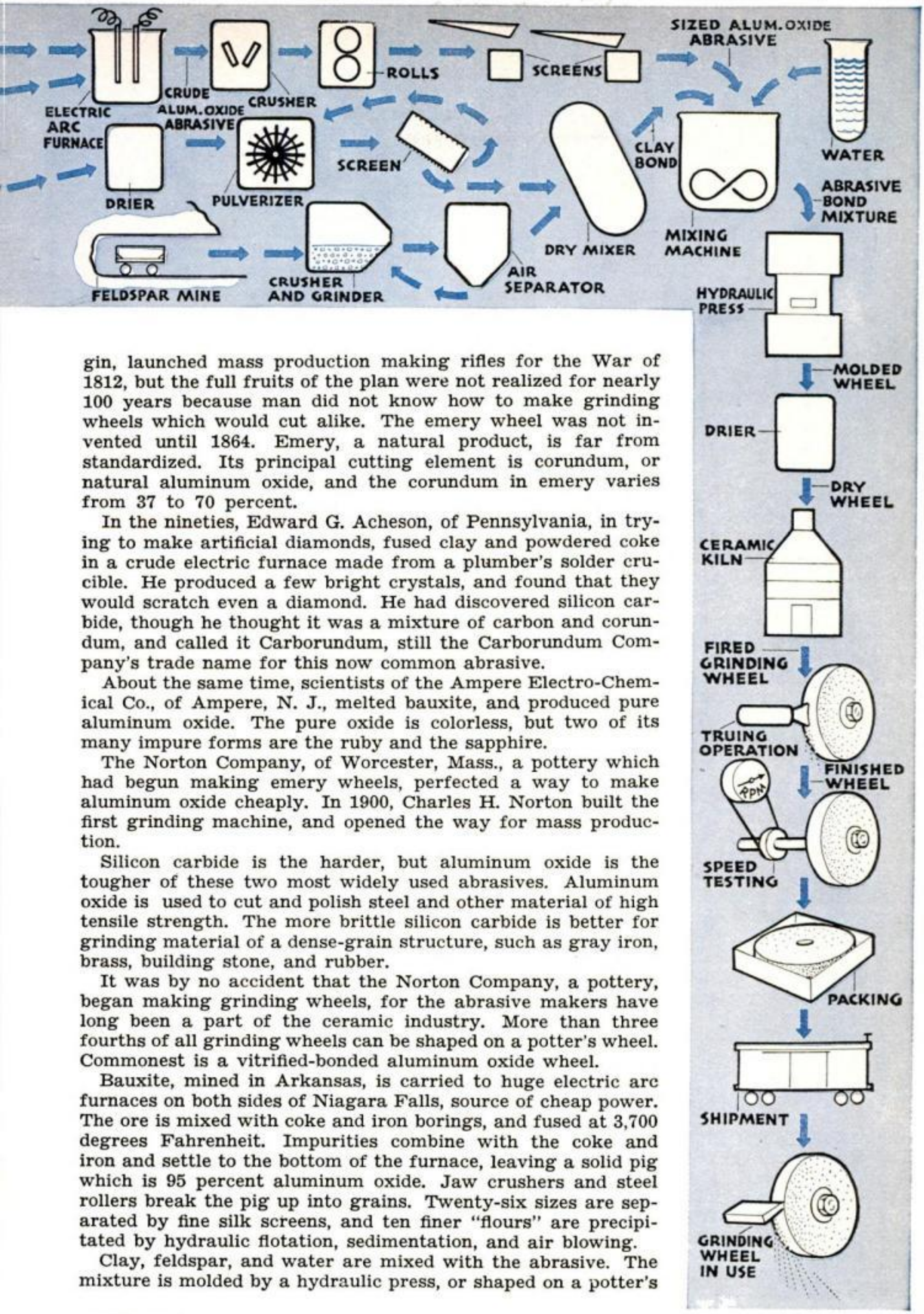

PAPER


GLASS


STONE

Grinding Touches Everything You Do

Wheels weighing from ten tons to ten grams grind cork and leather, porcelain and wood, marble and granite, concrete and all kinds of rubber, as well as steel, iron, and every kind of metal. The softness of flour, cocoa, and even face creams is ground into them by rolls finished to mirrorlike surfaces by other abrasive wheels. Your clothing and shoes, watch and keys, cigarettes and matches, money and billfold, pen and pencil, almost everything that you touch from morning until night, was either ground itself or made possible by grinding. Few could be made without it; all would be more expensive were it not for today's abrasives.



gin, launched mass production making rifles for the War of 1812, but the full fruits of the plan were not realized for nearly 100 years because man did not know how to make grinding wheels which would cut alike. The emery wheel was not invented until 1864. Emery, a natural product, is far from standardized. Its principal cutting element is corundum, or natural aluminum oxide, and the corundum in emery varies from 37 to 70 percent.

In the nineties, Edward G. Acheson, of Pennsylvania, in trying to make artificial diamonds, fused clay and powdered coke in a crude electric furnace made from a plumber's solder crucible. He produced a few bright crystals, and found that they would scratch even a diamond. He had discovered silicon carbide, though he thought it was a mixture of carbon and corundum, and called it Carborundum, still the Carborundum Company's trade name for this now common abrasive.

About the same time, scientists of the Ampere Electro-Chemical Co., of Ampere, N. J., melted bauxite, and produced pure aluminum oxide. The pure oxide is colorless, but two of its many impure forms are the ruby and the sapphire.

The Norton Company, of Worcester, Mass., a pottery which had begun making emery wheels, perfected a way to make aluminum oxide cheaply. In 1900, Charles H. Norton built the first grinding machine, and opened the way for mass production.

Silicon carbide is the harder, but aluminum oxide is the tougher of these two most widely used abrasives. Aluminum oxide is used to cut and polish steel and other material of high tensile strength. The more brittle silicon carbide is better for grinding material of a dense-grain structure, such as gray iron, brass, building stone, and rubber.

It was by no accident that the Norton Company, a pottery, began making grinding wheels, for the abrasive makers have long been a part of the ceramic industry. More than three fourths of all grinding wheels can be shaped on a potter's wheel. Commonest is a vitrified-bonded aluminum oxide wheel.

Bauxite, mined in Arkansas, is carried to huge electric arc furnaces on both sides of Niagara Falls, source of cheap power. The ore is mixed with coke and iron borings, and fused at 3,700 degrees Fahrenheit. Impurities combine with the coke and iron and settle to the bottom of the furnace, leaving a solid pig which is 95 percent aluminum oxide. Jaw crushers and steel rollers break the pig up into grains. Twenty-six sizes are separated by fine silk screens, and ten finer "flours" are precipitated by hydraulic flotation, sedimentation, and air blowing.

Clay, feldspar, and water are mixed with the abrasive. The mixture is molded by a hydraulic press, or shaped on a potter's

wheel, then moves slowly through a tunnel kiln 350 feet long, in which the temperature rises to a peak of 2,500 degrees. The grinding wheel is itself ground, to true it. Next it is run 50 percent faster than it will be in operation.

SILICON carbide is made by fusing glass sand, finely ground petroleum coke, sawdust, and common salt. The sawdust provides pores for carbon monoxide to escape, and the salt combines with various impurities to form chlorides, while the silicon of the sand combines with the carbon of the coke.

The proportion of binding material and the pressure used in molding a wheel determine the density and spacing of the grains, and this governs durability. The ideal wheel will sharpen itself as soon as the abrasive grains are dulled, but not before, and will cut as rapidly as is consistent with the desired finish.

Three hundred or more grinding operations go into the making of an automobile: it is a good car or a poor one according to the accuracy ground into it. Surfaces once considered practically perfect are no longer tolerated even in the cheaper cars.

Surfaces large enough are tested by reflection. One which will reflect newsprint so that it can be recognized is classed as commercial. If the letters are clearly defined, it is reflecting. Beyond this is Superfinish, described in the January issue of POPULAR SCIENCE MONTHLY, where under a microscope the surface is seen to be free of ridges, its only imperfection being a few tiny valleys.

Some reflecting surfaces are still ground by hand, with fine "flours," "sandpaper," or abrasive cloths. The "sand" on "sandpaper," incidentally, is usually garnet, silicon carbide, or corundum. In industry, most grinding is done by machinery, though much is done by a skilled workman holding a small grinding machine in his hand. For precision work and Superfinish, full machine-grinding is essential.

Most holes—in dies, cylinders, bearing pins—are ground by machines, whether straight, tapered, or formed. Special machines grind cams and other eccentric surfaces. A process called centerless grinding is used in both external and internal work to insure perfect roundness and because it is cheaper than the usual method, in which the center of the work is in line with the centers of an abrasive wheel and a regulating wheel, one on either side of the object being ground.

In centerless grinding, the work is supported by a beveled blade above the centers of the abrasive and regulating wheels. This permits the work to sink with a low spot and rise with a high spot, so that low and high spots "dampen" themselves out. In centered grinding, a high spot produces a low spot on the opposite side.

Furthermore, to grind between centers it is necessary to drill precisely located holes in the work, and adjust steady rests exactly. All this takes time. In centerless grinding, work can be loaded automatically by unskilled workmen.

Metals and most nonmetallic substances usually can be cut with an abrasive cut-off wheel at least twelve times faster and therefore more cheaply than by any other method except shearing. Sheared ends ordinarily must be ground, while ends cut off by an abrasive wheel seldom need finishing. The process is also far more precise than any other cut-off method.

There are 124 U. S. firms making abrasives; however, the two largest companies, Norton and Carborundum, not only divide half the business but with the next two, Abrasive and Macklin, three fourths of it. Last year the industry made products valued at more than $85,000,000. This was an increase of 20 percent over 1939, and the 1939 business was 28 percent better than that in 1938. Leaders of the industry expect 15 to 20 percent more business in 1941, and another increase of 20 to 25 percent next year.

Most abrasive workers are semiskilled. Graders are highly skilled, and father tends to train son in the trade. To meet demands for more efficient wheels, the larger companies employ big research staffs.

Probably the biggest user of grinding wheels is the automotive industry, with steel second. A close runner-up now is armament, and the airplane makers, railroads, machine-tool makers, shipbuilders, hardware, electrical, and paint manufacturers (who grind pigments) are all heavy users of abrasives. The glass industry, from the makers of plate glass to the finest optical instruments, uses tons of loose abrasives.

WITHOUT the art of grinding man would be reduced to living on fruits, nuts, roots, and vegetation growing wild, and on what meat he could snare or club, since grinding is necessary to shape and sharpen all but the crudest tools and weapons. He could weave only crude fabrics and sew only with bone needles. He would live in a hut or a cave, not a house. He would be able to travel only by horseback, on a raft or in a boat burned out of a log. All modern transportation and machine operation is based on the wheel, and without grinding he could not make even a wooden wheel.

Grinding thus ranks with the use of fire as one of the arts on which civilization rests.

5th

11th

30th

9th

3rd

4th

Soldier Engineers

THE U.S. ARMY'S MEN IN OVERALLS BACK UP THEIR MOTTO "GIVE US A TRY"

By LIEUT. COL. W. F. HEAVEY
Corps of Engineers, U. S. Army

WHEN the army moves across-country, the engineers have much to do with moving it. Their maps have outlined the route. Their roads carry the motorized forces and supplies. Their bridges cross the rivers which otherwise would block the progress of the army. If rails have had to be laid to the operating base, the engineers have laid them and the trains are operated by engineers.

It is the engineers who are indispensable in establishing bridgeheads in enemy territory. It is the engineers who plant mines and tank traps on unprotected flanks. It is the engineers whose camouflage protects the artillery positions and the supply dumps. In a pinch, when the enemy attacks in unexpected force, it is the engineers who throw down their picks and jack-hammers and fight with rifles and machine guns.

Engineers always have been an important factor in the conduct of war, but the exploits of the combat engineer troops of the German Army in Poland and the Low Countries have put new emphasis on their duties. It was these German pioneer troops, moving forward in some cases with structural steel exactly fitted and marked for certain bridge sites, who established bridgeheads.

It was these pioneers who stormed Eben Emael, near Liege, and other forts, both in the Low Countries and in France, which had been deemed impregnable. Eben Emael, rated one of the strongest fortifications in

Insignia of representative engineer outfits, shown above, symbolize the varied tasks of this important branch of the Army, and the spirit of its personnel

The 5th, 11th, and 3rd are combat regiments; the 4th is a combat battalion; the 9th is a motorized squadron, and the 30th is a topographic battalion

Typical of the engineers' fast-moving heavy equipment is this gasoline-powered shovel, which is towed on a trailer by a four-ton Diamond T six-by-six prime mover, at a speed of 20 miles an hour

Europe, lasted only seven hours after the pioneers, backed by aerial bombardment and parachute troops, got down to work. Advancing in their own smoke screen, the pioneers used flame-throwers and thermite grenades and then thrust through the deserted ports long jointed rods, on the ends of which were charges of explosive much more destructive than a 75-mm. artillery shell.

U. S. Army engineers, a large part of whom had been employed in peaceful years on flood control, harbor improvements, and supervision of Work Projects Administration jobs, did not neglect the study of German methods, though the German military engineering policy as a whole is not regarded as best adapted to American needs.

The German pioneer forces regard themselves primarily as combat troops. The American Army engineers are primarily technicians and the American Army recruit, almost invariably mechanically inclined to some degree, lends himself to such use.

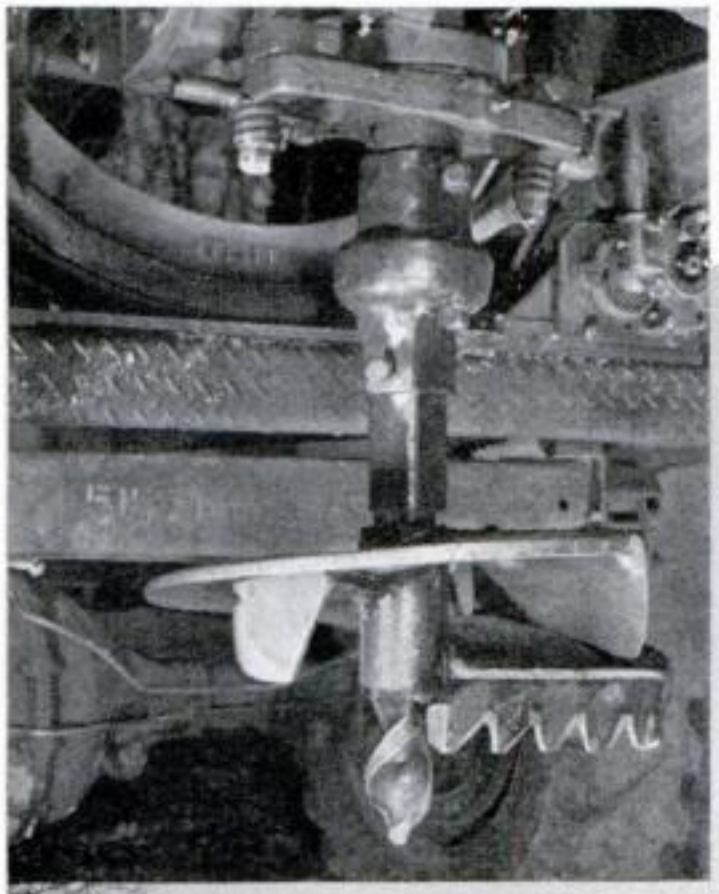
On June 30, 1939, the American Army numbered about 180,000 men, of whom 6,000 were engineers—one man in 30. On June 30, 1941, with 1,400,000 men in the Army, 85,000 of them, or one in 16, will be engineers. In active warfare the proportion probably would rise to one man in eight.

By the end of June each of the "square" divisions, the major component of which is four infantry regiments, will have a regiment of engineers. Each "triangular" di-

Bulldozers, also hauled on trailers, speed road building and field fortification. Standard industrial equipment is easily procured

Mobile concrete mixers like this provide material for making pill boxes and massive tank obstacles

vision of three infantry regiments and each armored division will have a battalion of engineers. Each cavalry division will have a squadron of engineers. Each army corps will have one or two combat engineer regiments and a topographic company. Each field army will have three regiments and six separate battalions of general service engineers, two dump-truck companies, two heavy ponton battalions, four light ponton companies, a topographic battalion, a camouflage bat-



. . . and here's an earth auger that bores holes for setting logs in tank traps. It is mounted to work at any angle. Inset shows 18-inch bit

talion, a water-supply battalion, a shop company, and a depot company. Two regiments of aviation engineers, trained in construction of flying fields in war zones, are attached to General Headquarters Air Force, and separate companies are stationed in Panama, Puerto Rico, and Alaska.

Experiments are being made constantly with methods of defense and attack at the Engineer School at Fort Belvoir, Va. There are courses in technique and tactics, surveying, drafting, map reproduction, water purification, and heavy mechanical equipment. It has become one of the largest special service schools of the Army, training 1,700 officers and 1,500 enlisted men annually.

Maintenance of roads and bridges and the construction of new ones probably would be the principal tasks of the engineers in wartime. Military operations are hard on roads, especially in this day of mechanized armies. It was far from negligible even 25 years ago. During the six-month battle of Verdun, traffic over the road between Verdun and Bar-le-Duc wore down ten feet of road metal in the aggregate.

The construction of new concrete roads is impracticable close to the front. An 18-foot macadam road will meet the needs of an infantry divi-

Pneumatic tools speed the engineers' work. This truck carries a powerful compressor, air hose, and various tools

. . . such as a chain saw for cutting up logs to be used in tank traps. This is a lot faster than a man-powered saw

Jack-hammers, too, get their kick from the compressor truck. They are handy for breaking up rock and enemy concrete

Below is an air-powered circular saw. All equipment is designed for fast and dependable service near the fighting line

sion fighting as far as 75 miles from its railhead. Every infantry division requires one such road. Dirt, gravel, plank, or corduroy construction will suffice for lighter traffic. For quick construction a "tread" road is built, supplying a bearing surface only for the wheels.

At the front, road construction is mostly by hand labor, though the combat engineers are equipped with air compressors, bulldozers, and other power machinery which can be used in some situations. It is planned to provide modern equipment, most of it too unwieldy for use at the front, for road construction in the rear areas.

Bridge building is the most familiar and probably the most spectacular of the feats of the engineers. Their technique is whetted to the point of getting troops across an unfordable stream under fire, an ordeal to test the caliber of any engineer outfit. Such an attempt would be made ordinarily either at night or under a smoke screen, and the technique must be proof against darkness and confusion, as well as enemy action.

For such work, the engineers are equipped with assault boats, light skiffs sturdily built of quarter-inch plywood, ten of which are carried in a light truck, nested like the dories on a fishing schooner's deck. American officers prefer these to the inflatable rubber boats carried by the Ger-

A "water point," or field water-supply setup. (1) Intake in lake or stream (2) Portable gasoline-driven chlorination and coagulation set, capacity 15 gallons a minute (3) 3,000-gallon portable settling basin (4) Pump (5) Sand filter (6) Line to storage tank

Building the water works: engineers staking out a portable canvas water tank. Wood ribs, and "hoops" of rope hold it rigid against pressure of water

Except for the tank, the water-supply truck unit below is completely self-contained. It can provide a flow of 75 gallons of purified water a minute

man pioneer troops. Each plywood skiff carries eleven fully equipped soldiers, nine of them infantrymen and two of them comprising the engineer crew.

In a recent test at Fort Benning, Ga., a complete infantry rifle company was ferried across the Chattahoochee River, there 320 feet wide and flowing four miles an hour, in 70 seconds through a smoke screen. A small outboard motor is available for use on the assault boats, but would be useful only in unusual conditions, as silence and surprise generally would be prime requisites.

All infantry weapons can be carried in the individual assault boats except the 37-mm. antitank gun. Several assault boats can be quickly assembled into rafts to ferry the antitank guns and the light trucks which draw them. For crossing wide rivers, such as the Mississippi or the Ohio, the engineers have ponton boats that carry 58 soldiers in addition to the crew and are driven by large outboard motors.

Once the advance party has got a footing on the far side of a stream, the engineers rig a sectional footbridge, a duckboard footway between whose slats the water is visible. Soldiers familiar with this style of bridge can cross it at a run in daylight. Familiarity is desirable because, if the soldier looks down at the water swirling under his feet it makes him dizzy. Engineers threw a bridge

To get infantry across a stream quickly, engineers build a sectional footbridge. Duckboard sections are laid across floats and fastened by spring clips as at left

of this kind across the Chattahoochee at Fort Benning in ten minutes, including installation of the anchor cable. Soldiers crossed it at the rate of 100 a minute.

Four 1½-ton trucks carry floats, duckboard sections, and cables for the construction of such a footbridge 432 feet in length. Under favorable conditions, a bridge of that length can be constructed in the field in less than half an hour.

Regular ponton-bridge equipment may be either light or heavy, the method of construction being the same with each. Latticed steel or aluminum supports are used in the shallow water near shore and a flexible joint called a

At left are parts of the duckboard footbridge. Float is a steel framework holding buoyant material, light enough to be carried by one man. Units like that below are assembled on shore and linked by spring joints

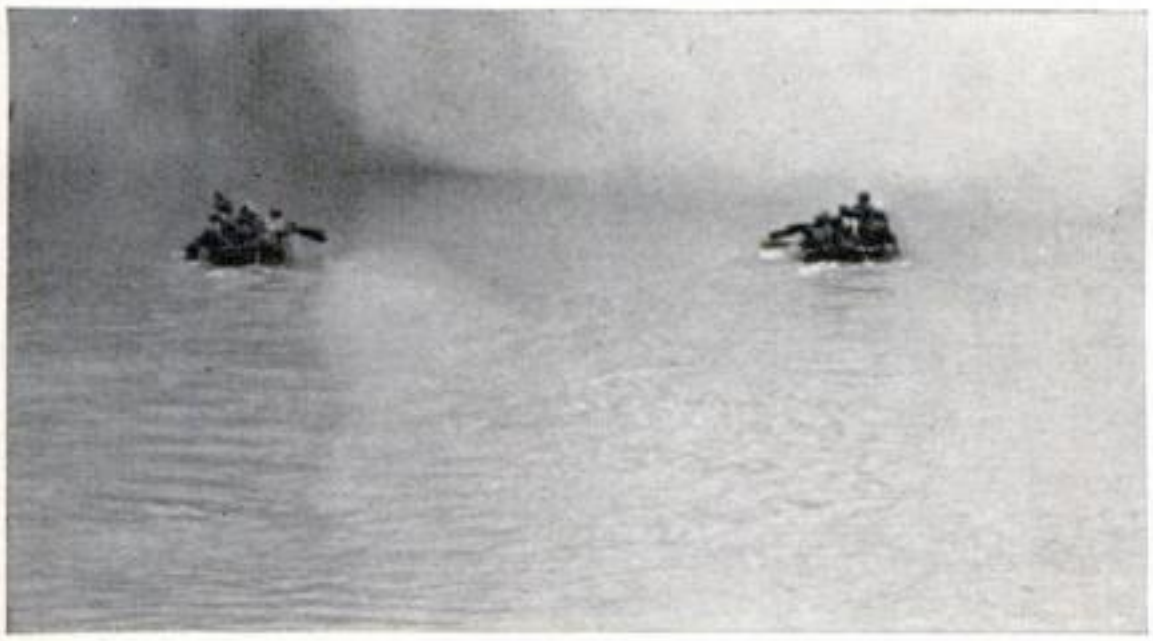
Trucks crossing a ponton bridge. A light ponton company carries material for 1,000 feet of bridge and lays it at about 100 feet an hour. Scow-shaped pontons could be maneuvered with outboard motors

saddle or hinge connects that part of the bridge with the part which is supported by pontons. Pontons are scow-shaped craft. The light ones have duralumin frames and aluminum skins and weigh about 1,400 pounds. Anchored at 16-foot intervals the bridge they support will carry light field guns, fully loaded three-ton trucks, and even light tanks. Reënforced with extra pontons they can be used by medium tanks. A light ponton company carries equipment for 1,000 feet of bridge and builds about 100 feet an hour. Heavy pontons are similarly made, weigh about 1½ tons, and make a bridge that will carry 155-mm. guns and medium tanks.

The engineers also carry portable bridge equipment for use where ponton construction is impracticable, including 72-foot-span steel highway bridges of 20-ton capacity.

Officers of the Engineer Board at Fort Belvoir have done much valuable experi-

For ferrying troops across water under fire to seize a bridgehead, the engineers provide assault boats . . .



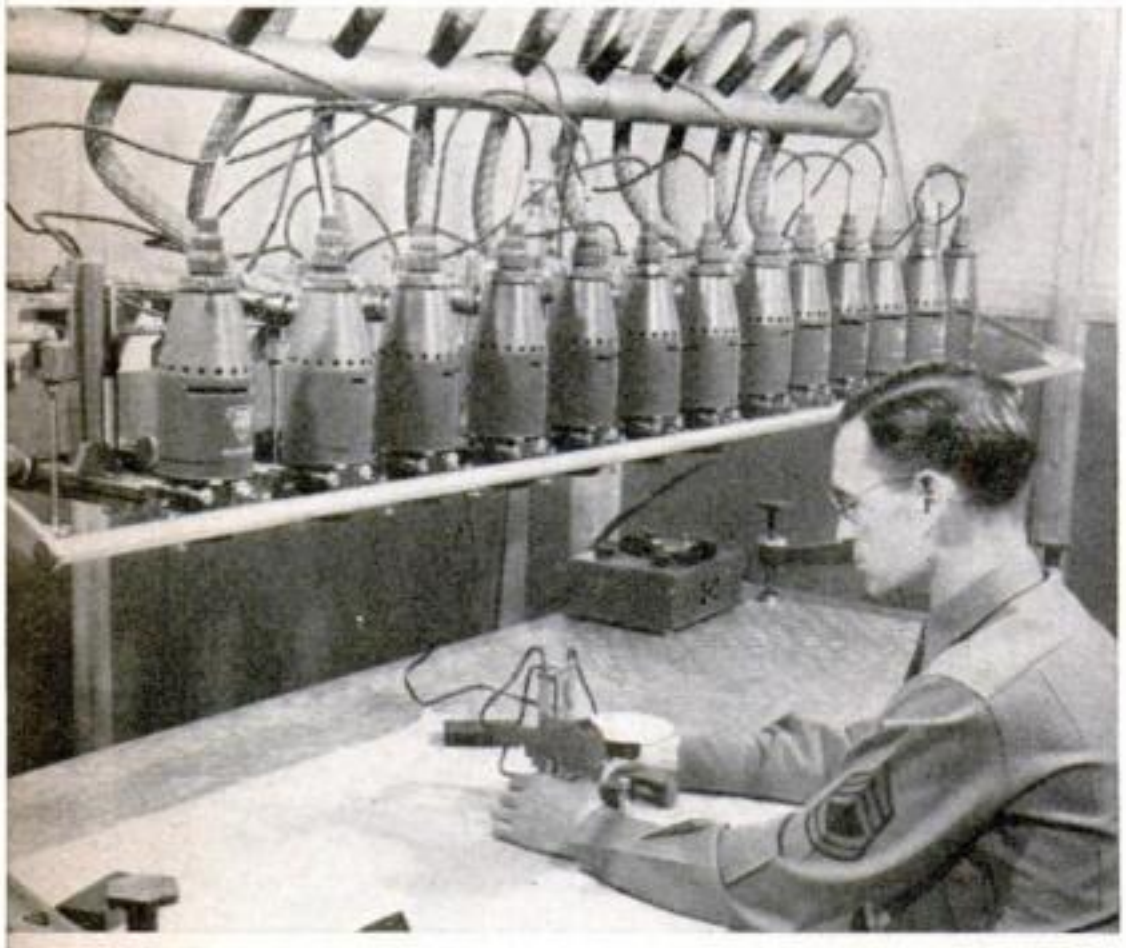
Ten nested assault boats are carried on a single truck. Our officers prefer them to German-type inflated boats

. . . light skiffs of plywood that can be handled by four men. Each holds 11 men

Map making is another job of the engineers. Here a roll of six-by-six negatives from an aerial camera . . .

. . . is put into a fixed-type printer to be reduced to diapositive plates. Pictures taken at different points overlap to give stereoscopic effect

Developed diapositive plates are placed in "multiplex" projectors which can be adjusted to compensate for tip or tilt of plane

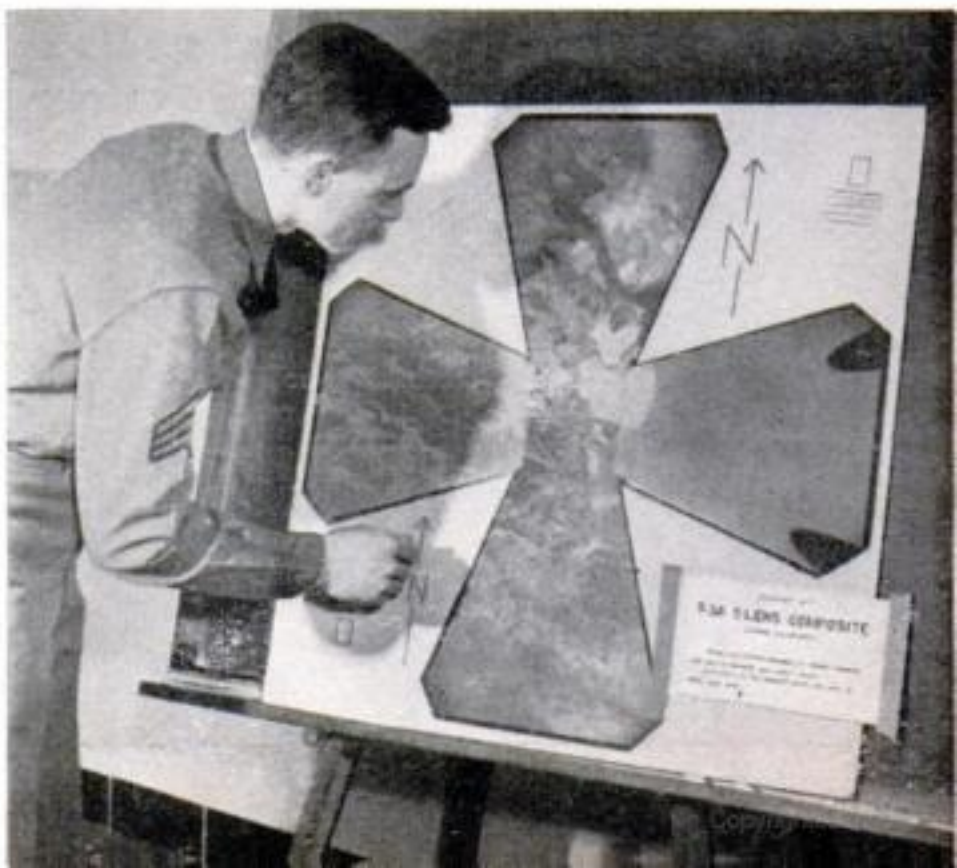


Overlapping images of blue and red, thrown on the map paper, give the effect of depth when viewed through a pair of glasses having one red and one blue lens. This enables the map maker to trace the contour lines easily

An editor checks details of the map. He is equipped with a hand stereoscope and prints of overlapping aerial photographs. The corrected map is ready to be printed in color

Short-order map work in the field is handled by this mobile printing plant, which is equipped to turn out 3,800 maps an hour. It uses the photo-offset process

The maltese cross below is a composite photograph made from the five negatives exposed simultaneously by a five-lens aerial camera



mental work in camouflage and a Los Angeles reserve battalion, most of whose officers are motion-picture technicians, has accomplished remarkable results in the camouflage of industrial plants.

Engineer officers have much to do with developing mechanical equipment for other branches of the service. They have contracted recently for $17,000,000 worth of searchlights for antiaircraft artillery. They were instrumental in the development of a knee-action trailer for the transport of 60-inch searchlights and their power plants. Four thousand of these trailers have been ordered.

The water supply for troops, the erection of barbed-wire entanglements, mine planting, and tank trapping are other details which occupy the attention of the engineers. Because of the possibility that supplies of T.N.T. might be limited in an emergency, the engineers have developed their own explosive which is practically as powerful and as safe to handle.

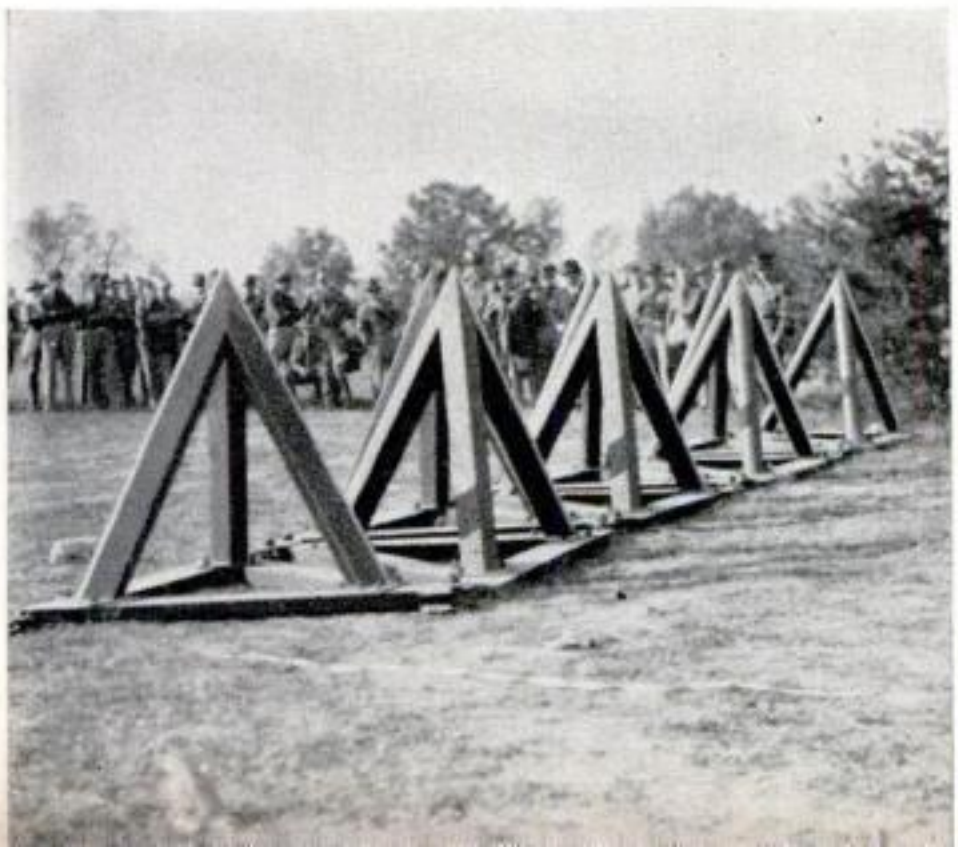
The engineers are organizing a railway operating battalion, which will be stationed near Alexandria, La., and operate light trains over 90 miles of its own track. Such a battalion, of about 800 officers and men, can maintain and operate a railroad division 100 miles long. Most of its officers will be railroad

Engineers destroy as well as build. Demolition of enemy defenses calls for expert handling of explosives and incendiaries (above)

For hasty erection of barbed-wire obstacles, corkscrewlike metal pickets are twisted into the ground

. . . and wire is strung along them. Special gloves studded with metal protect the hands

Tetrahedrons of fabricated steel are among the many types of experimental tank traps built by the engineers for actual tests by Army tanks . . .



. . . which showed that while a "hell buggy" could clamber over a single row of these obstacles, it was effectively blocked by a double line of them

National Guard majors, captains, and lieutenants try their hand at folding a camouflage net of the type used for screening supply dumps and positions of artillery

To erect such a screen, a network of wires is stretched between posts. Then the folded net is laid on top, as shown in the lower picture, and unrolled to cover the desired area

men who are in the reserve and the rank and file will be men who have had railroad experience.

The Army has 20 reserve railway-operating battalions, the officers of each of them being from a different railroad. Should it become necessary to mobilize these skeleton battalions, the enlisted personnel of each would be sought among employees of the railroad furnishing its officers.

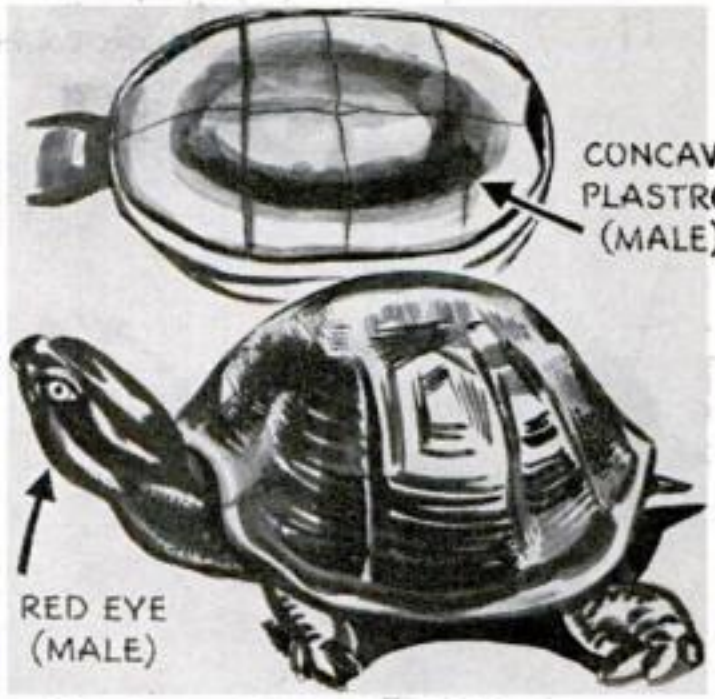
Even the recruits whom the engineers have received through the draft have proved to be excellent material, primarily because of the natural mechanical aptitude of American youth. Partly trained men are available in thousands for the Army engineers from among the Reserve Officers Training Corps students turned out annually by our universities.

Strips of cloth are tied onto the net, thickly near the center and thinning out toward the edges. To an enemy scouting plane, this would give the effect of a patch of mottled foliage

Un-Natural History

BY Gus Mager

THE **SHRIKE**, OR **BUTCHER BIRD**, IS A SANCTIMONIOUS ASSASSIN, CRUELER THAN HAWK OR OWL! IT IMPALES OTHER BIRDS, MICE, AND LARGE INSECTS ON THORNS BEFORE EATING THEM!



THE MALE **BOX TURTLE** HAS RED EYES, THE FEMALE YELLOW ONES! IN THE MALE, THE PLASTRON, OR UNDER PART OF THE SHELL, IS CONCAVE!

THE **GUINEA PIG** MYSTERY REMAINS UNSOLVED! THEY ARE NOT PIGS, BUT RODENTS, AND COME FROM SOUTH AMERICA, NOT GUINEA! NEITHER THEY NOR ANY LIKELY ANCESTORS EXIST IN A WILD STATE!

WASPS PRACTICED THE POTTER'S ART, AS WELL AS MASONRY AND PAPERMAKING, AGES BEFORE MAN TOOK IT UP! MEET THE **POTTER WASPS**, OR EUMENES FRATERNA, AND THEIR POTTERY NESTS!

THE ANCIENT MEXICANS BRED THE **MEXICAN HAIRLESS DOG** FOR ROASTING IN THE SKIN, ON A SPIT OVER A CHARCOAL FIRE! CERTAIN GOURMETS SMACK THEIR LIPS OVER IT!

MOLES HAVE UNDERGROUND STOREHOUSES, IN WHICH THEY KEEP HUNDREDS OF EARTHWORMS, ALL WITH THEIR HEADS BITTEN OFF, SO THEY CAN'T ESCAPE, BUT ALIVE - FRESH MEAT!

Stainless-steel blades of a giant windmill near Rutland, Vt., will provide electricity for a score of villages. Each blade weighs 22 tons. At the left is the 110-foot tower, being built to stand up under 140-mile-an-hour winds. Below is a portion of the generating machinery, which will be in a streamlined case at the tower's top

Cables laid along this clearing will carry current from the breeze turbine to near-by villages along a 200-mile-long power line

Mountain-Top Windmill

TO FEED VERMONT ELECTRIC LINES

THE STAINLESS-STEEL blades of the world's largest windmill, each blade as big as the wing of an Army bomber, will soon begin spinning on a New England mountain top, generating electric current from the wind. Seventy-five tons of steel will rotate at the top of the 110-foot tower of this experimental wind turbine, located in the Green Mountains, ten miles northwest of Rutland, Vt. Invented by Palmer C. Putnam, of Boston, Mass., and sponsored by T. S. Knight, a vice president of the General Electric Company; Walter Wyman, president of the Central Vermont Public Service system, and Beauchamp Smith, vice president of the S. Morgan Smith Company, one of the world's largest manufacturers of turbine equipment, the 1,000-kilowatt station is scheduled to begin commercial operations this summer.

All the generating equipment is housed at the top of the tower in a streamlined, metal-shelled egg, 50 feet long and 20 feet in diameter. It is tilted downward to face the updrafts of the mountainside and, like a weather vane, is free to rotate. The twin blades, cutting a 175-foot circle through the air at the rear of the streamlined housing, can cone backward as much as twenty degrees to lessen the pressure of heavy gusts of wind.

By the use of an automatic mechanism, similar to that on an adjustable-pitch propeller, the angle at which the great blades cut through the air will be varied according to the velocity of the wind, thus keeping them spinning at a steady pace of 28.7 revolutions a minute. Through a double set of gears, this speed is stepped up to whirl the generator at 600 revolutions a minute. In gales, the blades can be turned edgewise to the wind to reduce resistance. The whole structure has been designed with sufficient strength to withstand 140-mile-an-hour hurricane winds. Yet, an 18-mile-an-hour breeze will be sufficient to generate current, and at 30 miles an hour the plant can operate at load capacity. For 3,500 of the 4,500 hours a year that the station will be in operation, it is calculated, the plant will be running at full capacity, generating enough current to light 10,000 100-watt lamps.

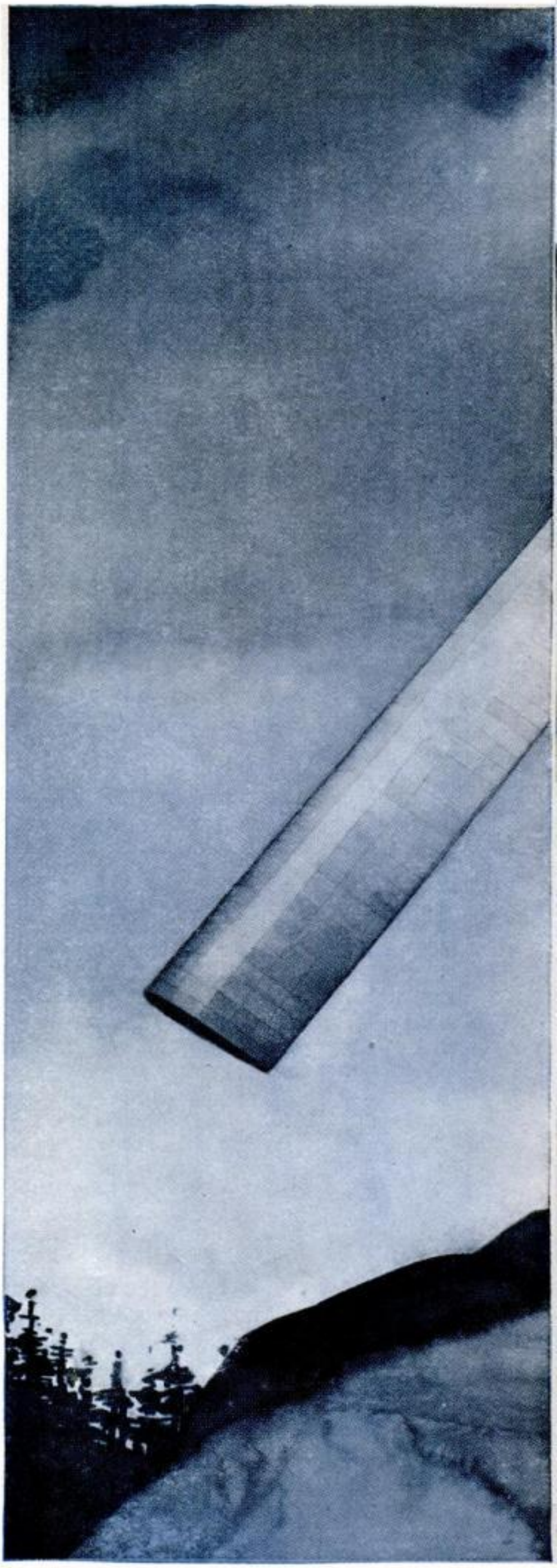
Five years of concentrated research preceded the start of actual construction last December. Putnam, a graduate of the Massachusetts Institute of Technology, de-

vised the basic pattern of the wind turbine. Later, more than seventy variations were worked out on paper. The Library of Congress, as an aid to the research, prepared a bibliography on wind turbines that included 1,400 titles. Finally, six different models were put through performance tests in ten consecutive 24-hour days at the Leland Stanford wind tunnel, in California. At times, as many as three different engineers were tackling the same problem and, all told, more than 200 trained scientists, under the general direction of Dr. J. B. Wilbur, head of the Structural Analysis Laboratory at M.I.T., aided in the refinement of detail.

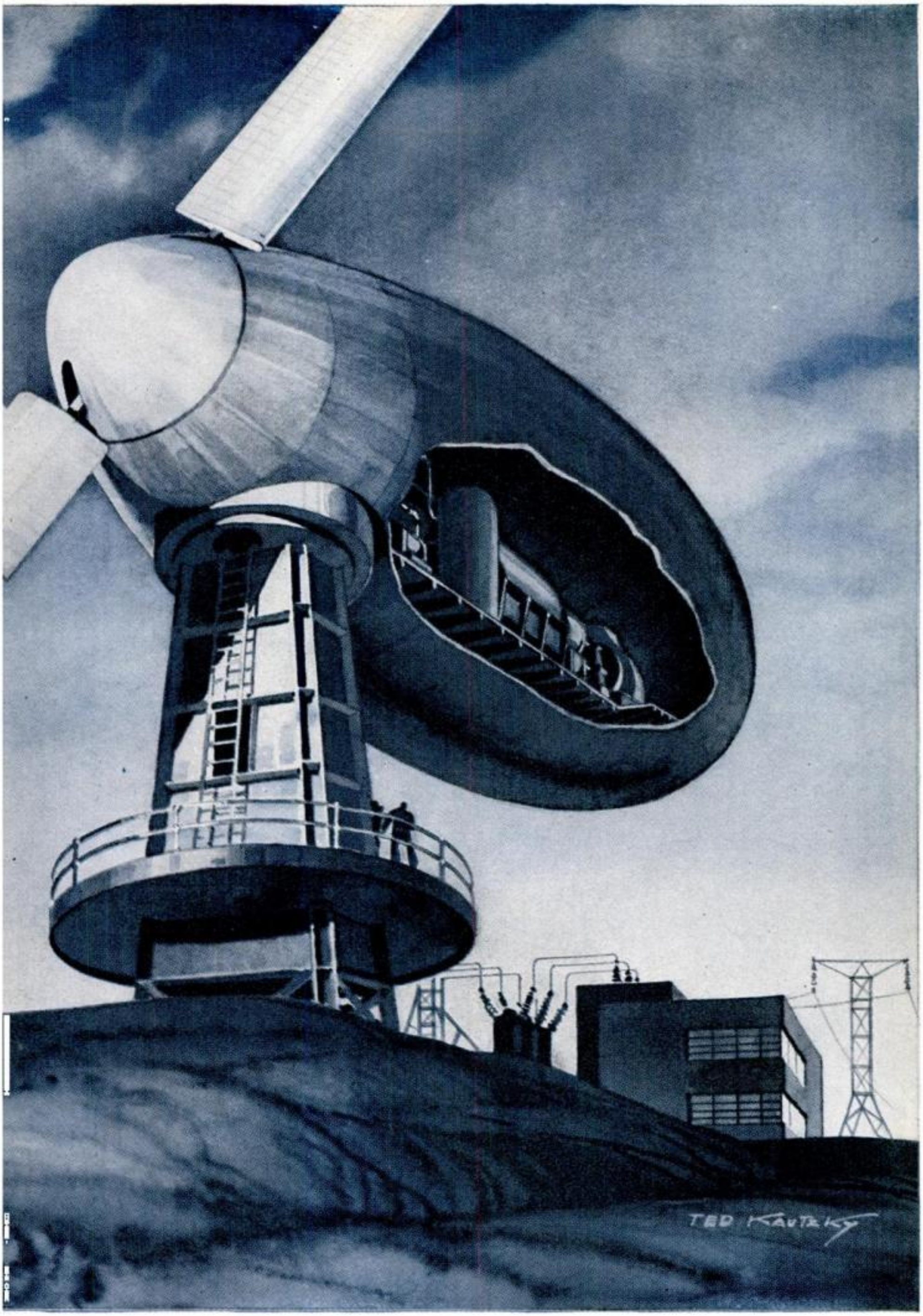
The hardest nut to crack was to keep the great windmill spinning in gusty weather at the uniform pace demanded for the production of alternating-current electricity. Two features of the design have solved the problem: the use of variable-pitch blades and the fact that the station's output will flow through the same circuit as current from a neighboring hydroelectric plant. If a sudden gust tends to speed up the windmill before the blades can be adjusted to the new wind velocity, the mountain-top station will automatically take on part of the load of the hydro plant. The effect is the same as though the two generators were connected with a long, flexible shaft. If one generator, under such conditions, started to speed up, it would have to twist the shaft as well as carry its normal load. This "electrical brake" is counted on to prevent sudden, violent fluctuations in speed.

While the first installation is being made on a mountain top, meteorological surveys indicate that suitable winds exist at such diverse locations as the great plains and on certain marine islands.

Success in this attempt to harness the wind of a New England mountain top to the production of electricity will have special importance at this time. Wind turbines would provide a new, cheap source of power for rapidly expanding defense industries. They could function where water power is unavailable, and they could be erected in one-third the time required to build hydroelectric stations of the same capacity. And such generators, scattered among the hills, would be far less vulnerable to attack from the air in wartime than larger and more obvious hydroelectric plants, or steam-powered generating plants which are usually located in congested industrial areas.



An artist's idea of what the huge windmill will look like when it is completed this month. The housing for the generating equipment is 50 feet long and 20 feet around, and tilts down to face the mountain updrafts. Each blade is as big as the wing of an army bomber



ASSEMBLING SKELETONS for medical schools and private collections might not appeal to some people, but it's all in the day's work for John F. Lonergan, of Chicago

It's a Living

THE butcher, the baker, the candlestick maker represent traditional ways of earning bread and butter for the family table; but thousands of persons take their livelihood from little-known occupations. Who ever would think of crocheting large commercial signs, riding a mechanical elephant, or painting with chewing gum? Yet men and women are doing exactly those things, and making a living at it. Photographers visited some of these people, to make pictures for "Unusual Occupations," a Paramount short subject. They turned their cameras on a man who scrubs swimming pools with a vacuum cleaner, another who fits skeletons together from assorted bones, a third who tastes soap. It's a living!

HER FISTS ARE HER FORTUNE. From punching a typewriter's keys Doris DeGreen turned to punching a bag as a professional instructor

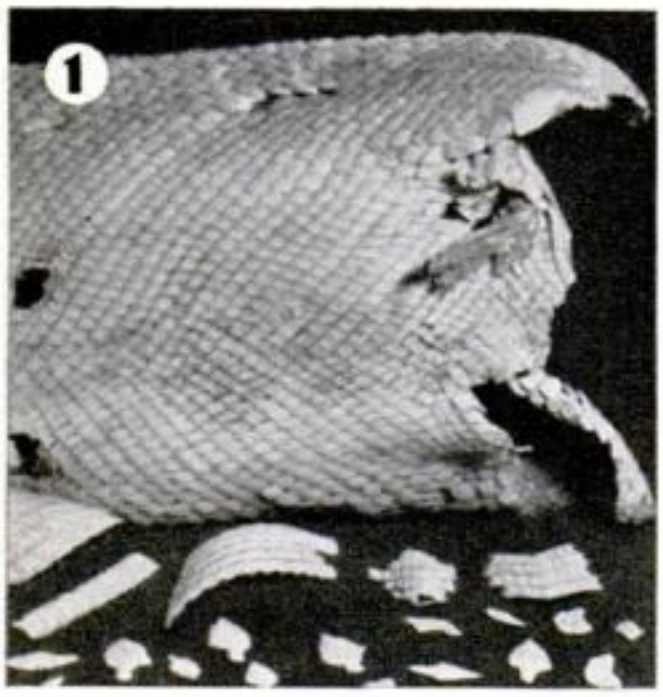
KNIFE THROWER. When a knife thuds into the wall near a movie hero's head, it probably comes from the steady hand of Steve Clemente, Hollywood cutlery tosser. At the left he is about to throw part of the kitchen stove, with a sharp edge

DOLLS IN FRAMES mean bread and butter to Alice Daly. She cuts backless figures from cardboard, covers them with cotton batting, and clothes them with ribbon. Faces and hands are made out of flesh-colored cloth

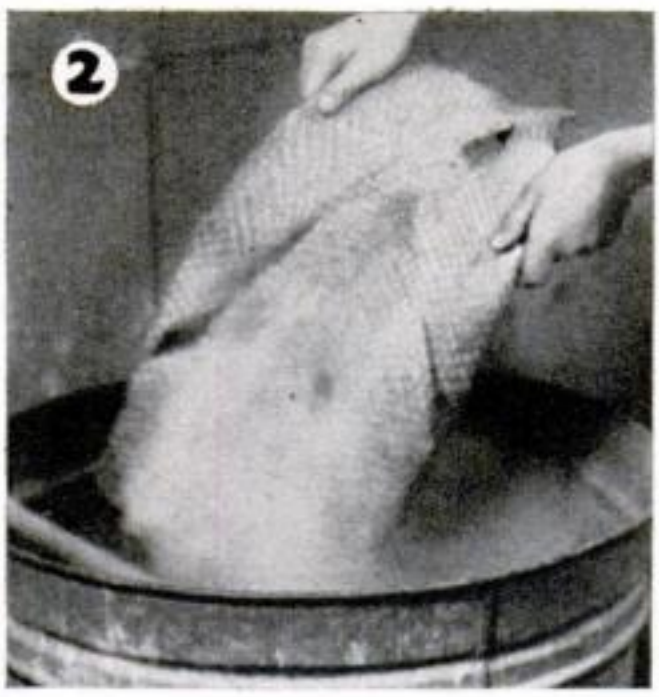
TASTING SOAP in a Los Angeles factory is Joe Strohl's job. To see when each new boiled batch is done, he submits a sample to his trained palate. At least, it's clean work!

FISH-SCALE JEWELRY

JEWELRY carved from the scales of the giant gar fish, which infests Louisiana bayous and preys on game species, now helps pay for war on this enemy of fishermen. The odd craft was originated by Percy Viosca, Jr., of New Orleans. For men, the ivorylike scales become watch charms, tie clasps, and lapel ornaments; for women, necklaces, bracelets, and hair clasps, as demonstrated by Viosca's daughter, Yvonne, at right. Other products include mosaic serving trays and wall plaques.



1 Scales and hide of the giant gar fish show the varied shapes available for carving into ivorylike jewelry

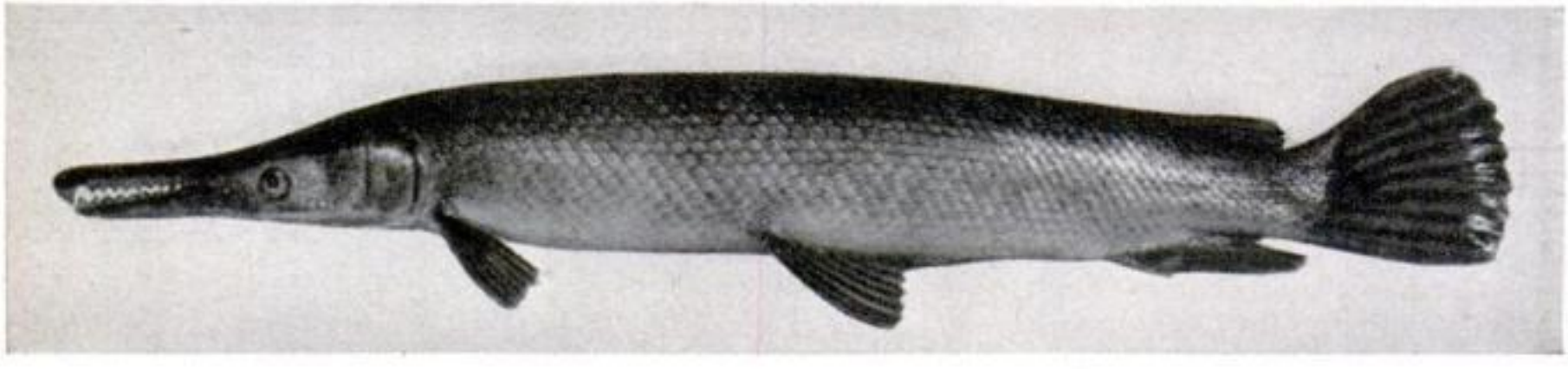


2 One of the hides is given a bath in chemicals to separate the scales and bleach them. This is the first step taken in making ornaments

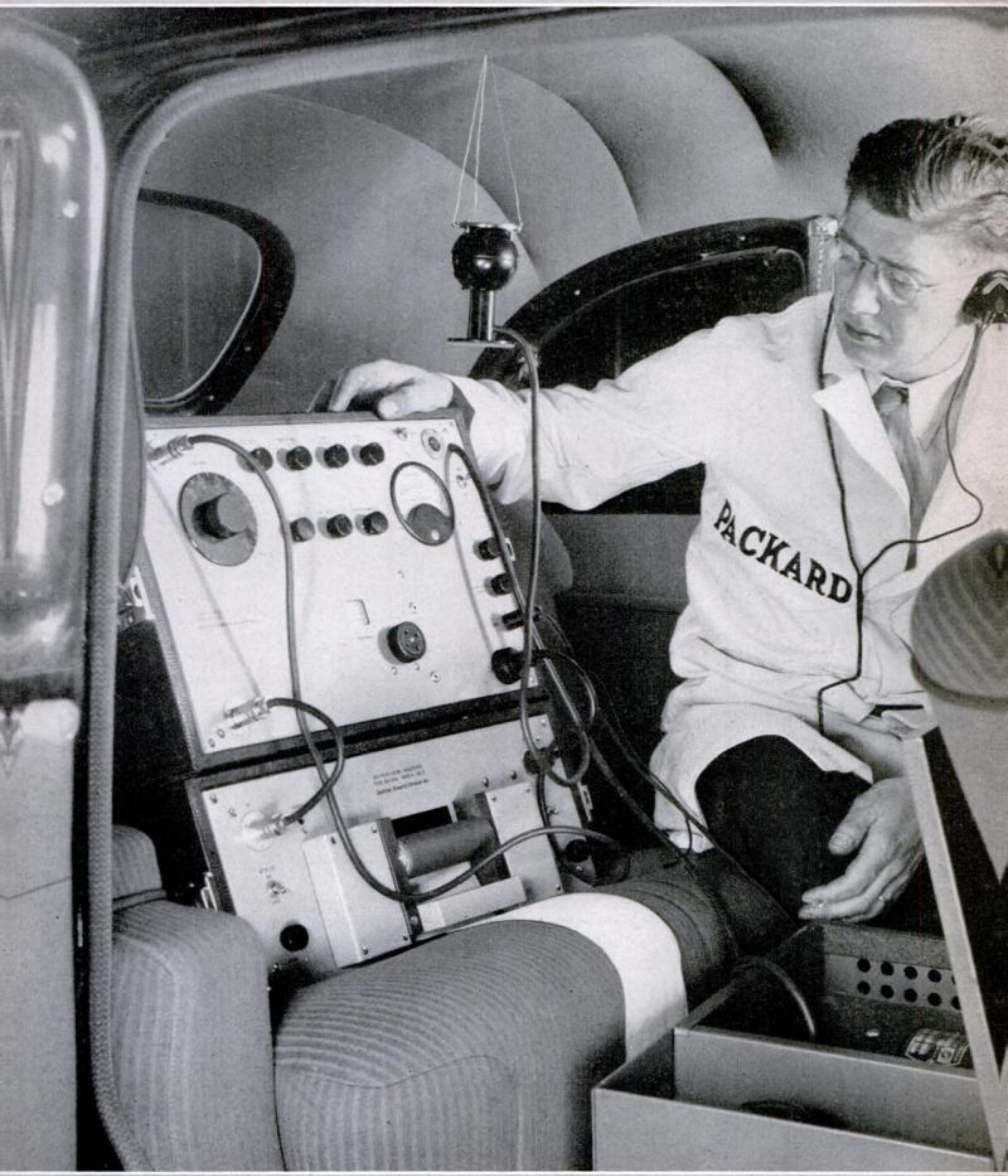
3 The worker uses a motor grinder to carve the scales into miniature fish

4 A power spray is used in coloring the scales. Next in the process is drying them in special racks

Giant gar fish grow to a length of 8 feet and weigh 200 pounds



AUTOS



DETROIT'S NOISE DETECTIVES GIVE YOU QUIETER CARS

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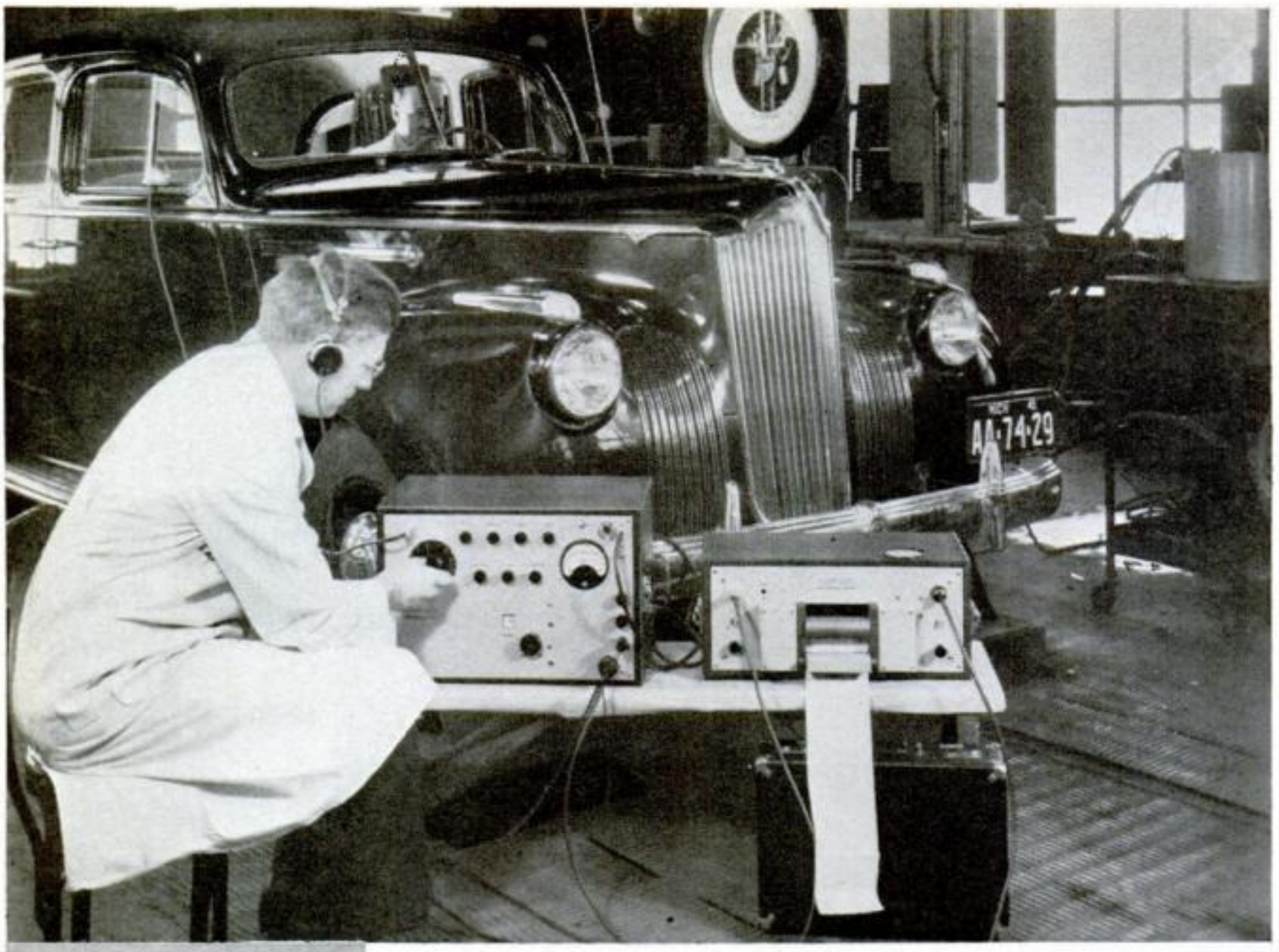
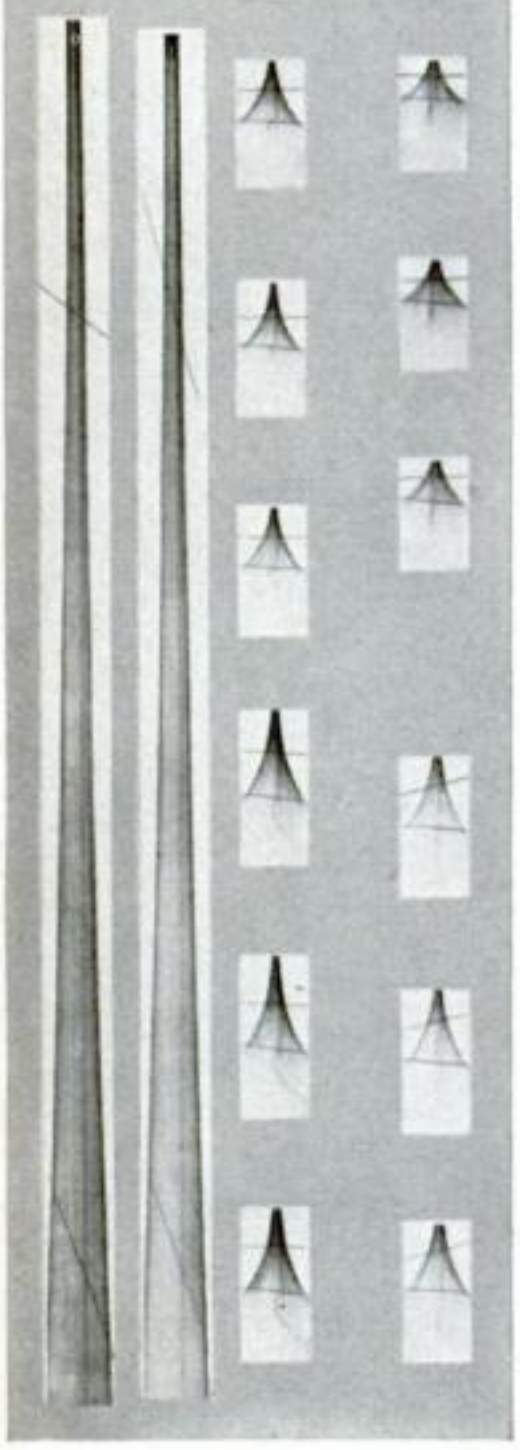




Measuring car noises with a sound-frequency analyzer. At left, moving film records of sound "decay" in untreated metal panels (far left) and treated panels. Notice how the application of sound-deadening materials quickly dissipates the sound

How Microphones and Sound Meters Help Build Silence into Car Bodies

By SCHUYLER VAN DUYNE

ONCE you could tell the make of an automobile a block away by ear. People then said that one car chugged, another make whistled, still another purred. Any schoolboy could call the turn.

Today you're good if you can even hear a car a hundred feet away. And all cars sound so much alike that people—including schoolboys—have stopped trying to identify them that way.

Credit for this magic curtain of silence dropped over the nation's cars belongs almost exclusively to the "acoustical engineers" in the car makers' sound laboratories in and near Detroit. It is because of them that your new car doesn't sound like a light tank going into battle.

In one laboratory, at the General Motors Proving Grounds, I recently stood in a room so quiet that after a minute I could hear my own heart beating. In this and the Chrysler, Ford, and other laboratories, I saw engineers using instruments that "remembered" sounds they recorded a year or five years ago. Name any car—Hudson, Nash, Packard, Studebaker, Willys, or one of the products of the Big Three—and

One type of sound-deadener used on body panels can be sprayed on. Automobile workers have christened it "goo"

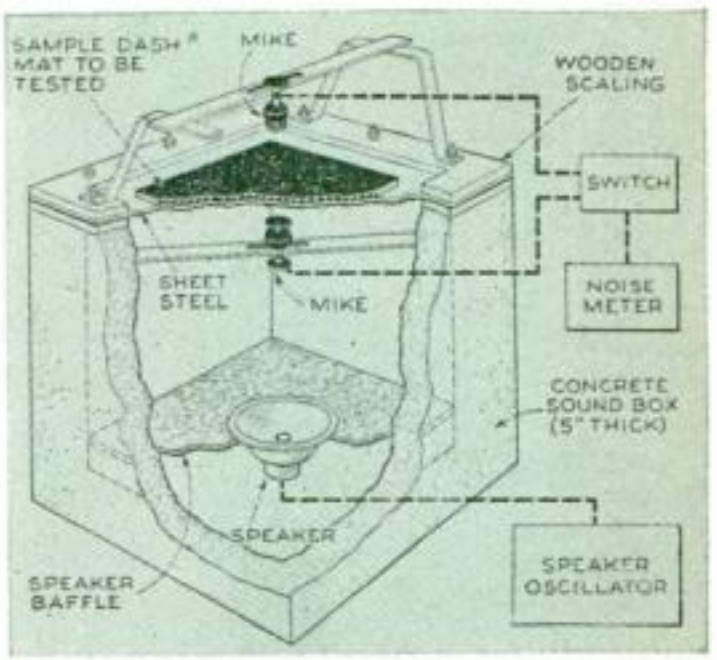
you'll find comparable equipment.

Not many car noises, the engineers tell you, come from engines, which today are so well balanced that they produce scarcely any vibration—the basis of all sound. Some noises may start at the wheels, springs, or engine fans. Carburetor intakes, engine drive shafts, exhaust mufflers, account for others, or would if the engineers allowed it. Car floors of sheet steel have all the racket-making qualities of a dance-band drummer's cymbal, and every square inch of those shiny doors, body panels, roofs, and trunk lids is capable of offending the critical motorist's ears. You can add to these the noise of air rushing around moldings and window recesses, tire-against-pavement noise, and the plain noise of rain or hail on the steel top.

To measure these sounds, and analyze and compare the materials that kill them, engineers use such instruments as vibrating loudspeakers, microphones, amplifiers, cathode-ray oscilloscopes, and sensitive electric meters. At one laboratory I watched them testing sound-deadening material for body panels. Samples were struck with a baseball hung on a cable and swung from a fixed distance. A microphone picked up the sound and carried it as electrical energy to a sensitive meter, which measured the strength of the sound in decibels and showed how long it continued.

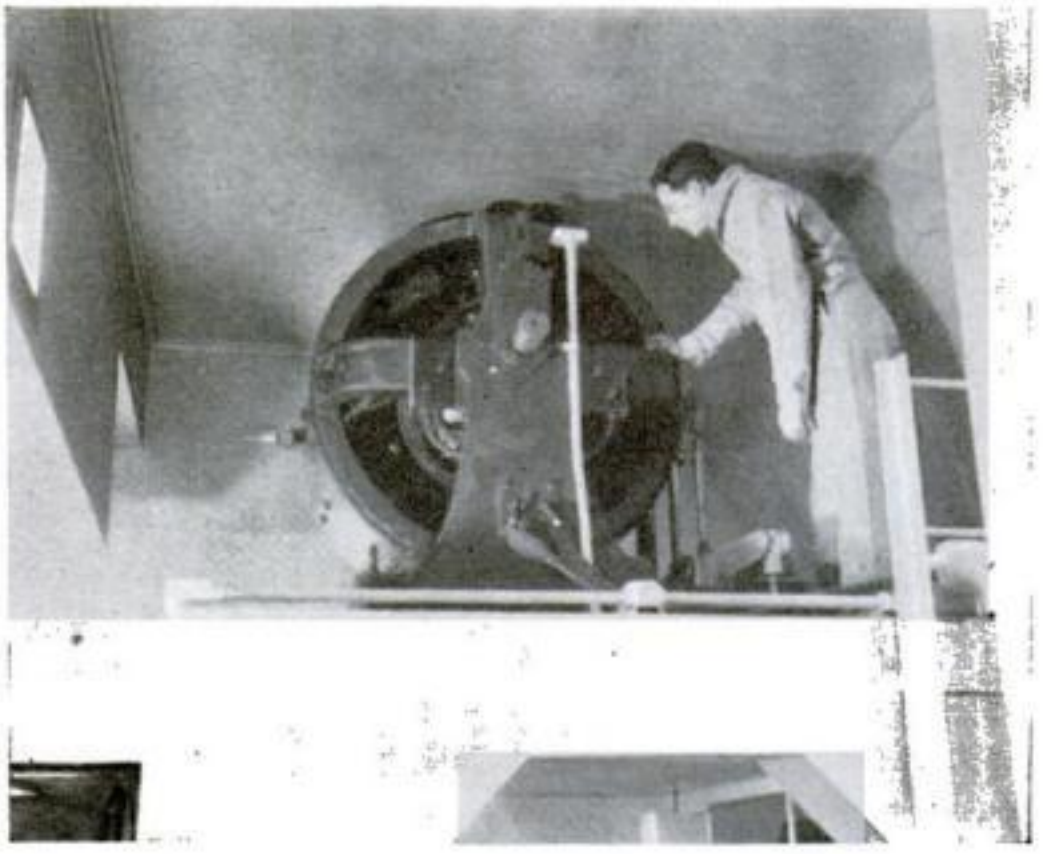
At another laboratory, engineers

General Motors saved nearly $200,000 in one year with this $50 concrete box. It was used to prove that a cheaper dash mat really did the best job



In the open air on top of this proving-ground sound laboratory, cars run under their own power while sound instruments measure the type and pitch of unwanted noises at any speed or at any given load

"Oscar" (the microphone at upper right corner) is the ears for the sound experts making the tests. He can be placed in any part of the automobile



This generator, connected to the rollers on which the car wheels rest, provides the required load against which the engine of the vehicle must work

How cars are conveyed to the roof of the General Motors sound laboratory's outdoor dynamometer

pointed out a concrete box in a corner of a quiet room. The box cost $50 to construct, without instruments.

"It saved the company nearly $200,000 last year," one of them said. He explained that an inexpensive dashboard-insulating mat used in one line of their cars had proved so superior as a sound deadener, under comparative tests in the box, that it was selected for other lines as well, over much more expensive mats.

Few single tests yield such big dividends. But they all add up to immense total savings. An engineer put it this way: "To make a car completely quiet inside, we'd have to fill it up with sound deadeners. But it's the first thin layer that does most of the work. Our job is to make that do

A sample of a muffler baffle. Inserted at bottom of the adjustable column at right, its ability to absorb sounds of many frequencies is studied

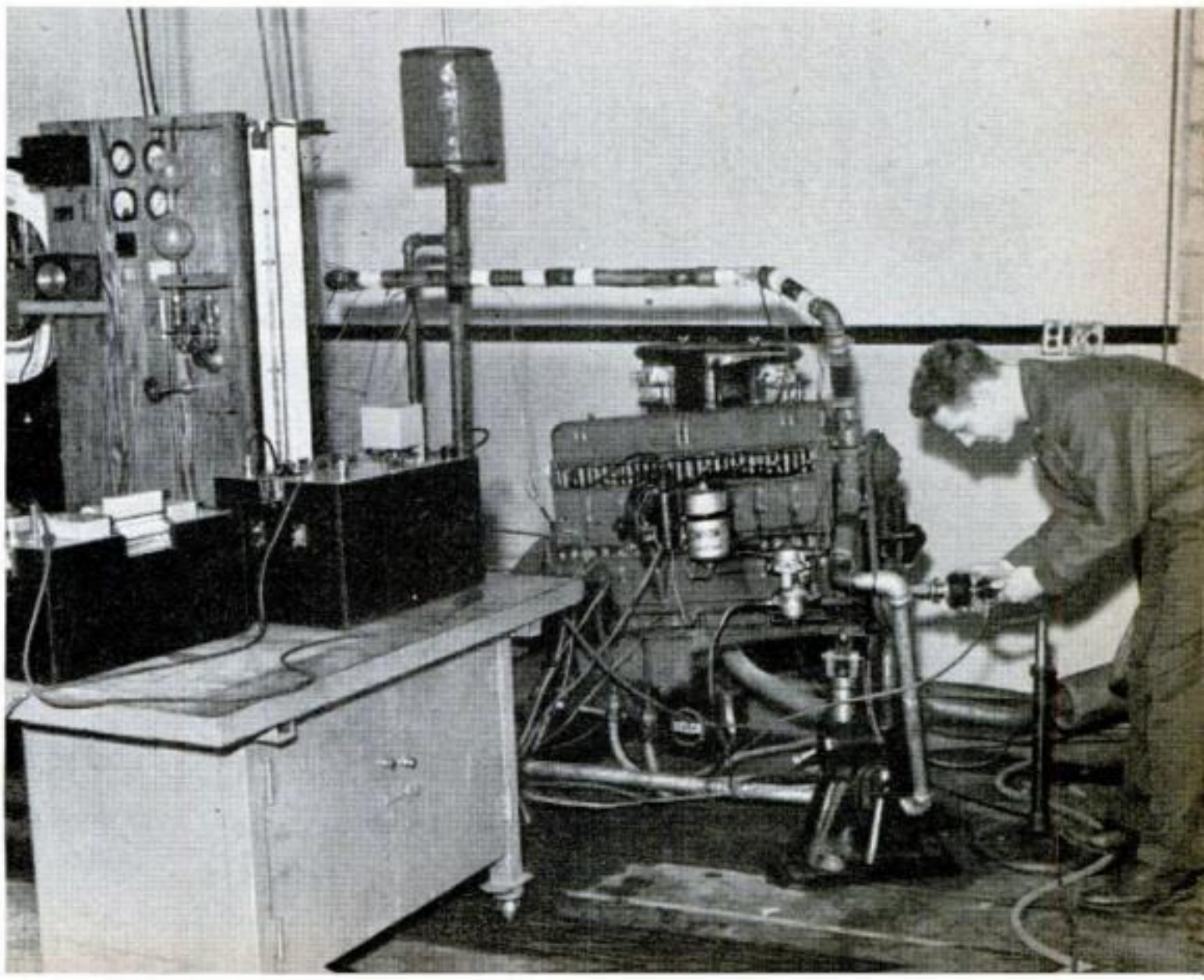
the work better—and for less money, too."

And here is a partial summary of the sound deadeners these specialized experts have placed in your new cars. The dashboard may consist of a felt deadener cemented to steel and backed by an insulator of jute topped off with fiber board. Under the top there may be a half-inch blanket of cotton and wool fiber, sandwiched between paper sheets, to kill rumbles and deaden the tinny sound made by rain or hail.

Besides a mat of felt on your car floor, there probably are jute pads, to block out wheel, pavement, and chassis sounds. In addition, the steel floor is ridged to prevent any snapping effect such as you get when you press on the bottom of an oil can.

Trunk lids, all body and door panels, and the wheel housings are insulated with tar-like, sprayed-on sound deadeners, or felt pads, or both. And innumerable joints of stationary as well as moving parts are cushioned with rubber.

It was all tested first by the acoustical engineers, and, if you can't hear your own car at 20 paces, or if you feel rested after a long drive, thank them for it.



Vibration, important key to many a noise in cars, is here being studied. A stock motor on a dynamometer is run at many speeds with a vibration recorder fitted to its crankshaft end

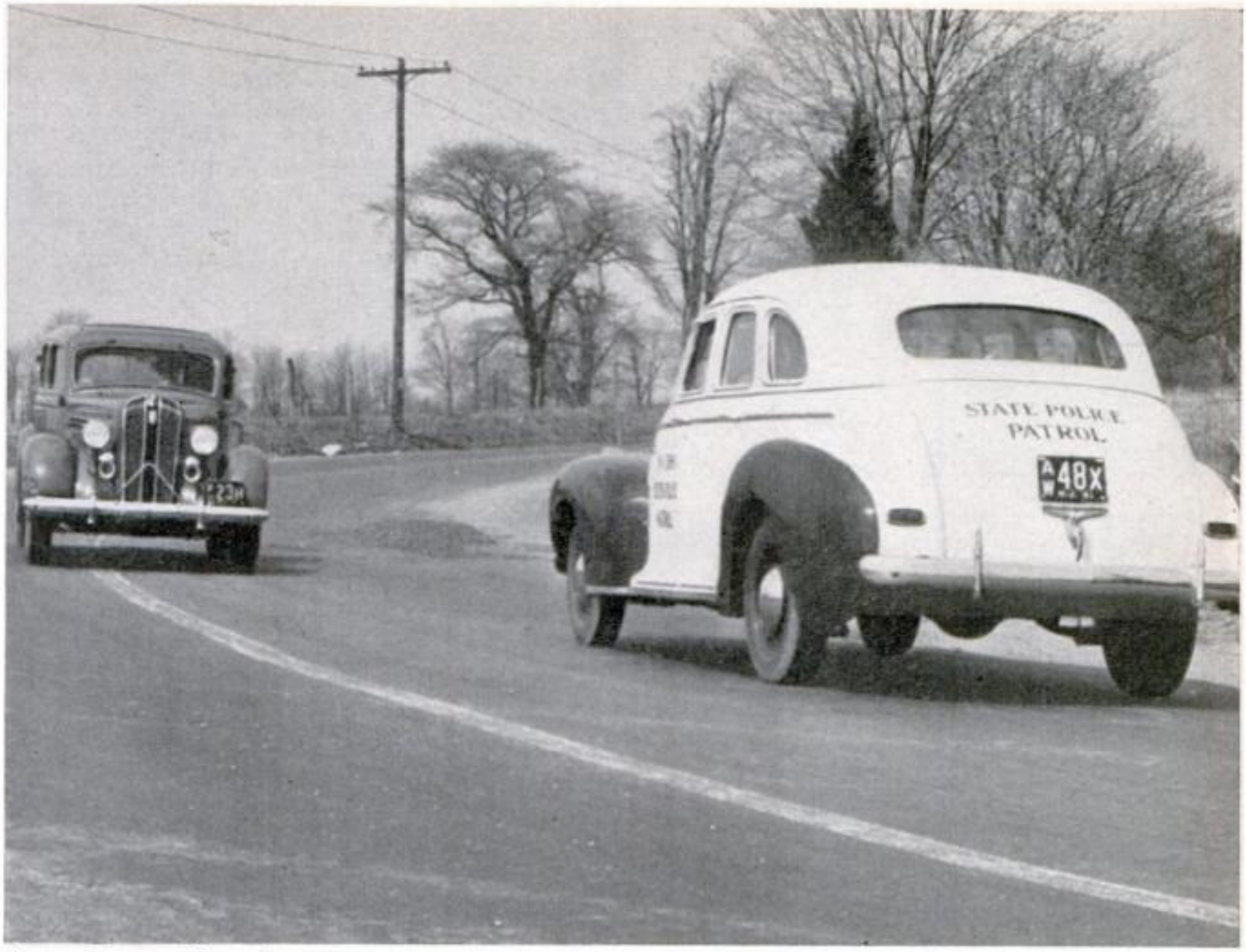
Preston Foster tries out his new vacation wagon. The canvas awning covers the rear-deck kitchen

VACATION CAR

LOOKING LIKE a cross between a streamlined sedan and a station wagon, an elaborate vacation car, specially designed for Preston Foster, Hollywood star, keeps life luxurious during hunting and fishing trips in the Southwest. Reading lamps, radio, refrigerator, Pullman-type bed, cupboard, gas stove, and a dustproof compartment for guns and fishing tackle, are included. The 116-inch wheelbase permits easy maneuvering on the sharp turns of mountain roads.

A generator powered by a 1⅞-horsepower motor in the nose of the car runs the automatic refrigerator shown in the bottom photo

Foster swings the rear bumper down to provide room for the kitchen under the rear deck. Below, he tunes in on weather reports at bedtime



The car approaching the camera has crossed the center line into the left-hand lane, dangerous on a curve

Drive Safely

DO THAT AND YOU'LL AVOID ACCIDENTS AS WELL AS TICKETS, SAY THE HIGHWAY POLICEMEN

By PAUL NELSON

"NINE times out of ten, a warning will do more to make a motorist drive safely than a traffic ticket. We try to get people into the habit of looking after their own skins. If they'll only do that, the safety of the other fellow will usually take care of itself."

This was the first of a lot of evidence I was to get that New Jersey's nattily uniformed troopers are as well grounded in human nature as they are in the traffic laws. The speaker was driving me from the Trenton office of Col. Mark O. Kimberling, superintendent of the State Police, to a small troop substation at near-by Columbus. I was spending a day with the troopers on their rounds of highway duties to get pointers on how to drive more safely. It was certain that their total annual travel of nearly 7,000,000 miles along the state's highways added up to a lot of experience, and it seemed logical that the roads in central New Jersey were pretty much like those to be found in almost any state.

At the Columbus substation, the sergeant in command turned me over to one of the ten troopers under him. There are more than twenty of these groups, quartered at substations scattered throughout the state and each commanded by a noncommissioned officer. With the trooper to whom I was assigned, I climbed into a black-and-white patrol

Topping a hill in the center of the road is one of the worst things the motorist can do. Almost a fourth of New Jersey's deaths on the highway last year occurred on curves or grades

This pedestrian has learned the lesson the sign is designed to teach and is walking against traffic, the only safe way

A frequent cause of crack-ups along superhighways is crossing from an outside lane in front of another car. The right way is to approach the turn in the lane the police car is using

car, and soon we were out on a four-lane highway where traffic was heavy.

I watched the driver closely. He kept the car almost at the legal speed limit and drove steadily along the outside lane on his side of the highway. Up ahead, a car plodded doggedly along in the left lane. It drew a honk from the patrol-car horn as we came up behind. A second honk failed to move it out of the passing lane. A police whistle got action.

"If we could only get drivers to follow the rules, it would be a lot simpler and safer for everybody," the trooper said. "See that sign we're coming to?" It read: "Drive To Right. Pass In Center."

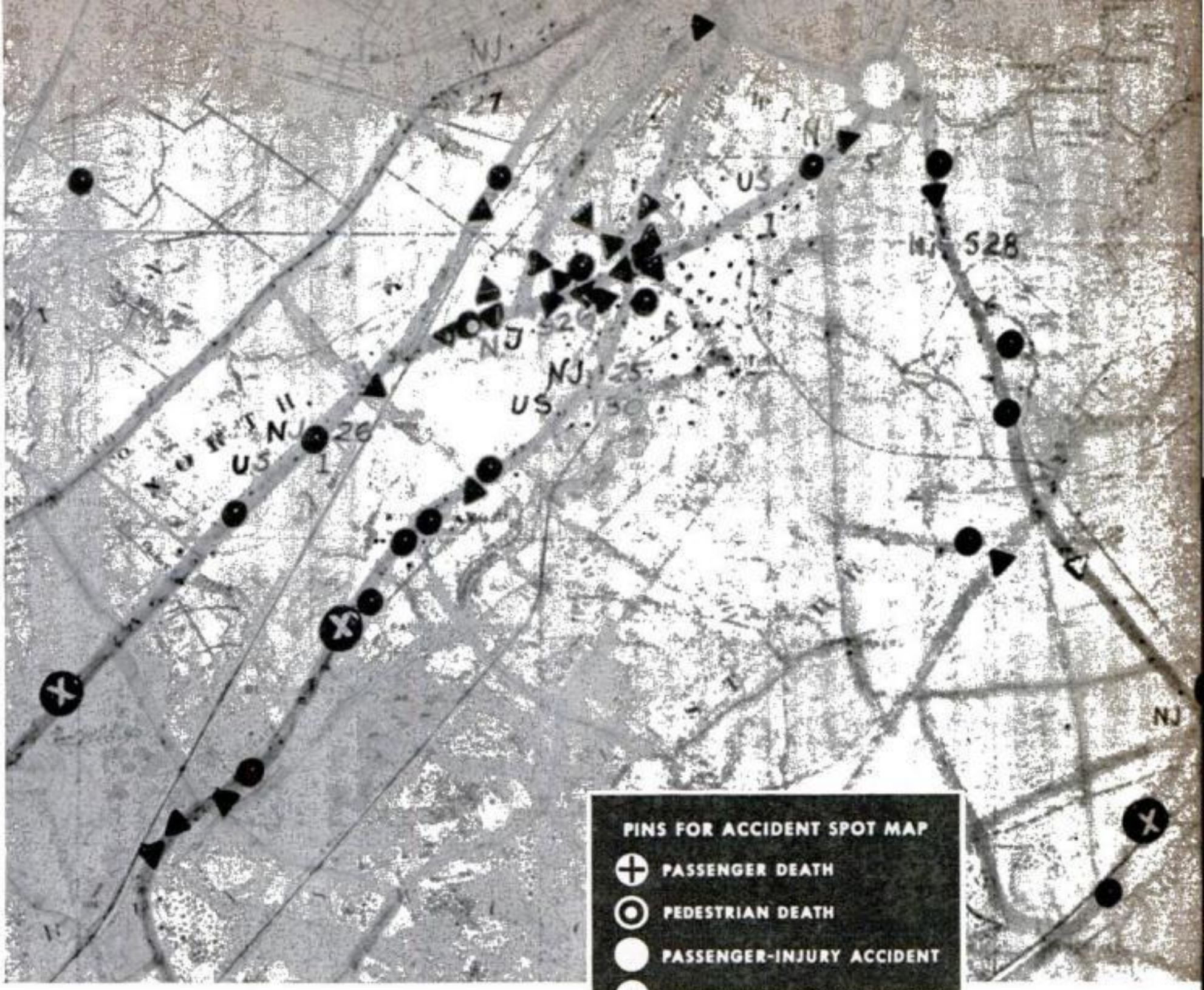
"Couldn't be much plainer, could it? Yet day and night we find cars cruising slowly along in the center where faster-riding cars are prohibited by law from passing them on the right, and can't safely pass on the left. It's real road-hogging!"

We slowed to make a left turn and the trooper put out his hand as he sidled toward the center of the pavement. "Never make a left turn from the right-hand lane. If you do, you're apt to cut off another car coming up from behind. Plenty of collisions happen that way," he warned as he came to a full stop to wait a chance to cross oncoming traffic.

We turned into a two-lane macadam road. He kept his speed down and took curves consistently on the right side of the road, the wheels never crossing the white center line up hill or down.

"You can't get into trouble this way," he assured me. "If a tire blows, we can stop without losing control, even on this high crown. If we put our right wheels off the pavement onto this sunken shoulder, we'll still stay under control."

He demonstrated the point. But before turning the car back over the edge of the pavement, he let it slow down, made sure no cars were close behind us, and then climbed



To dramatize accident-concentration points pins are stuck each day in a map of New Jersey hanging on the wall of Police Headquarters at Trenton

back to the pavement at a sharp enough angle to forestall a skid. "If you're going fast when you do that, your angle of approach will be too small and your tires may catch on the edge of the pavement. Then you're in a skid."

As we climbed a grade around a bend, he told me that 50 of the 223 traffic fatalities investigated by his organization last year happened either on curves, grades, or curved grades such as this. "Never overtake another car on a grade, and always stay on your side," he cautioned.

"What's the safest time of day or night for driving?" I inquired.

This seemed to be any man's guess, he told me, since there's no complete record of the number of cars abroad at all hours of the day, to be checked against the accident records. Furthermore, the accident rate varies with the type of road, the weather, street lighting, and season. And there is no time when motorists should exercise anything but utmost caution.

We passed another roadside sign that warned pedestrians to "Walk Facing Traffic. At Night Carry Light."

"Pedestrians need to use caution, too," he said with emphasis. "We investigated 66 pedestrian deaths last year. Believe it or not, almost a third of those pedestrians had been drinking."

After checking in at another substation, I set out with a different trooper. I asked him for his opinion of the driving skill of young people.

"Speed is the danger element with kids," he felt. "Most of them, as soon as they get the hang of driving, want to 'see how fast she'll go.'" Older beginners seem to know better, he believed, adding that if 'kids' could be kept down to safe speeds, they might have the best accident record of any age groups.

We turned into a gravel-surfaced country road. It was barely wide enough for two cars, far from smooth, and it curved sharply between straightaways.

I was told that country drivers handle their cars with due respect on such roads, but

Police live in substations, and though most are married, get but 12 nights and 3 days off a month

Substations of New Jersey's State Police are mostly converted homes. A sergeant commands, in this instance at lunchtime

was asked to emphasize the fact that they are tricky. "They'll throw you into a skid—or a ditch—quicker than a wink!"

Whether you are accustomed to driving mostly on city streets, superhighways, macadam, or gravel, the important thing is never to depend on your brakes and tires to do your safe driving for you, this trooper said.

A trooper I talked with before winding up the day handed me the annual report of his department. He turned to the page which recorded that there were 542 drunken-driving accident cases investigated by New Jersey State Police during 1940—one out of every eight of all types. But the report also showed that nearly as many—492—involved drivers who were otherwise "physically defective, handicapped, fatigued, or sleepy."

In other words, a quarter of all the in-

Sergeant G. W. Stevenson gives three men of his typical detail of 11 officers their "OD's," as they call their orders of the day, at the substation at Columbus. New Jersey has 26 of these units, basic in the handling of crime as well as in control of traffic

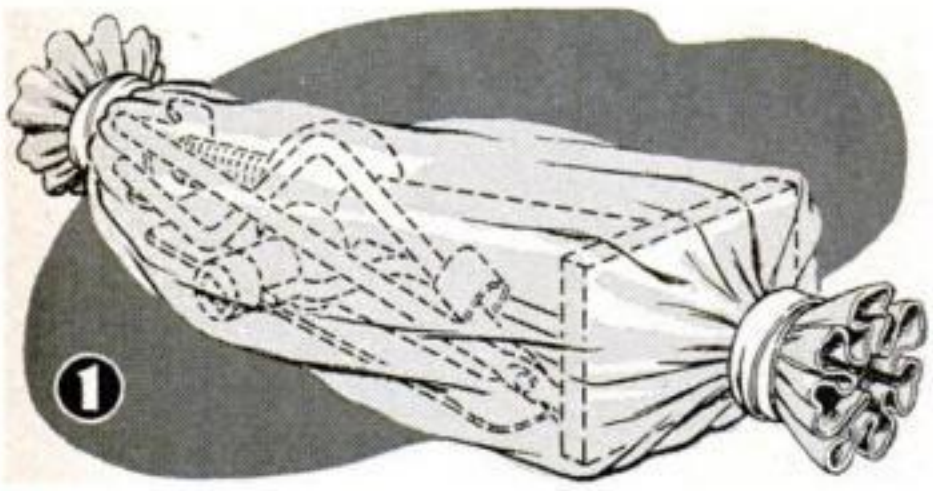
vestigated accidents involved drivers who were not in a normal physical condition.

The report also pointed out that "enforcement—important factor that it is—can never hope to cope adequately with the accident problem. Departmental efforts for years have given wholehearted support to all educational and engineering programs designed to make our streets and highways safer. Enforcement energy is constantly being directed to educate and correct either by summons, warnings, or both, those drivers who will not respond to other methods."

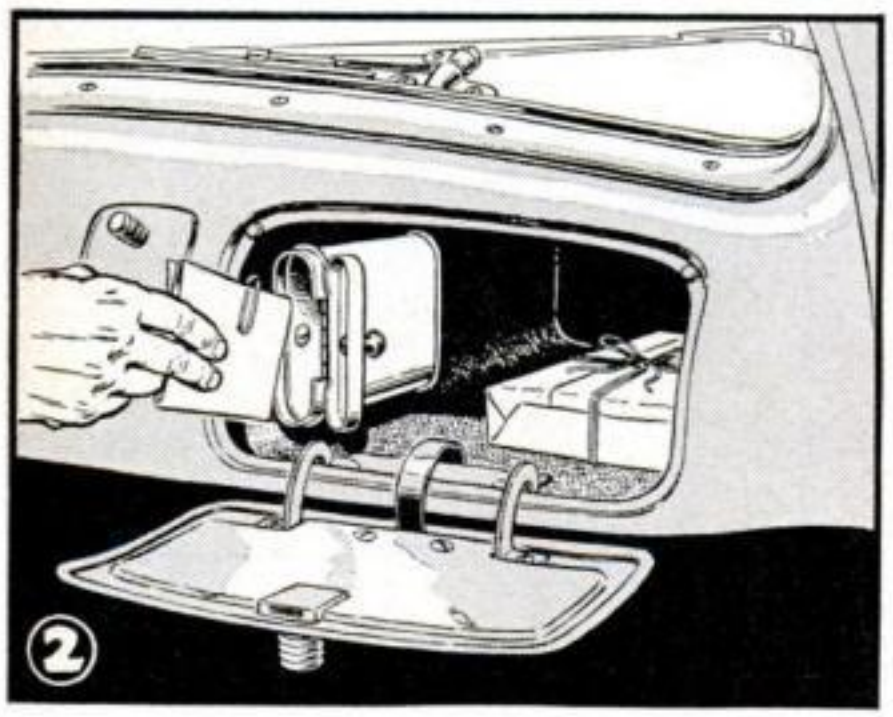
It made it clear to me why highway safety, to these troopers, was a problem resting largely in the hands of drivers themselves. That lanky, smiling trooper had packed a lot into his statement: "Nine times out of ten, a warning will do more to make a motorist drive safely than a traffic ticket."

Troopers must keep familiar with each State's car plates, even when the same state may have two in effect at once—one not yet expired and one just issued for the next year. It's a tough task to know them all, particularly since there are changes from time to time

SEVEN NEW IDEAS



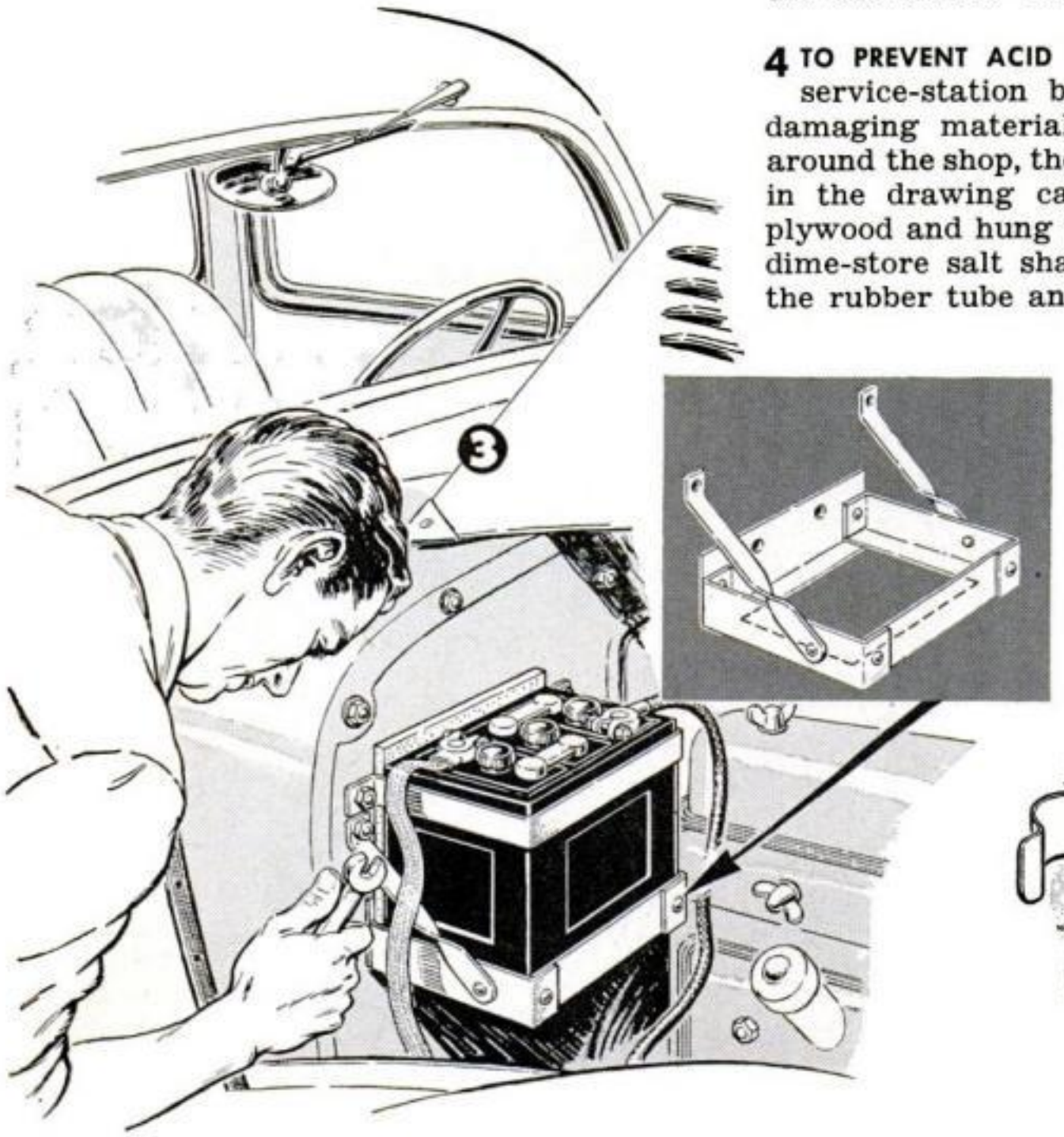
1 PACKING THE CAR JACK in an envelope of rubber cut from an old inner tube serves a double purpose for the car owner. It prevents caked mud picked up by the jack from messing up the tool compartment, and also eliminates any possibility of the jack rattling on bumpy roads. Heavy rubber bands, likewise cut from inner tubing, seal up the ends of the jack casing.—A.H.W.

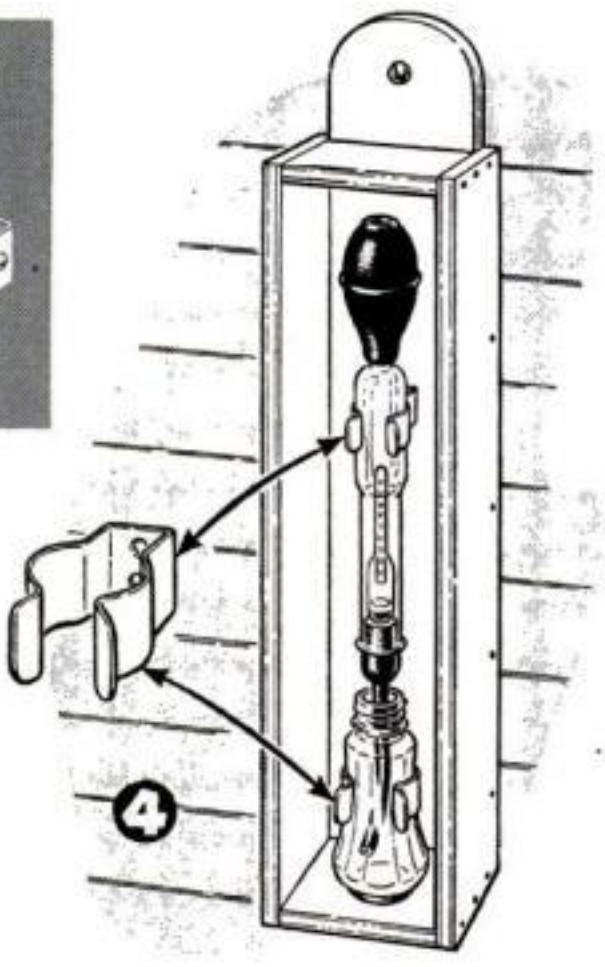


2 REGISTRATION AND LICENSE cards for your car will always be handy if they are stored in a repainted tobacco tin bolted to the inside of your dashboard glove compartment. Attach a pot-lid knob to the lid of the tin to facilitate opening it. Mount the tin with the hinge away from the wall of the compartment.—K. R.

3 A DASH-MOUNTED BATTERY will do a lot to modernize your car. Make a supporting framework as shown in the accompanying sketches, using scrap angle iron or heavy sheet metal—at least 16-gauge. Rivets, or nuts and bolts with lock washers, should be used for assembly. Use fiber-board sheets under the battery and to separate it from the dashboard.—R. V.

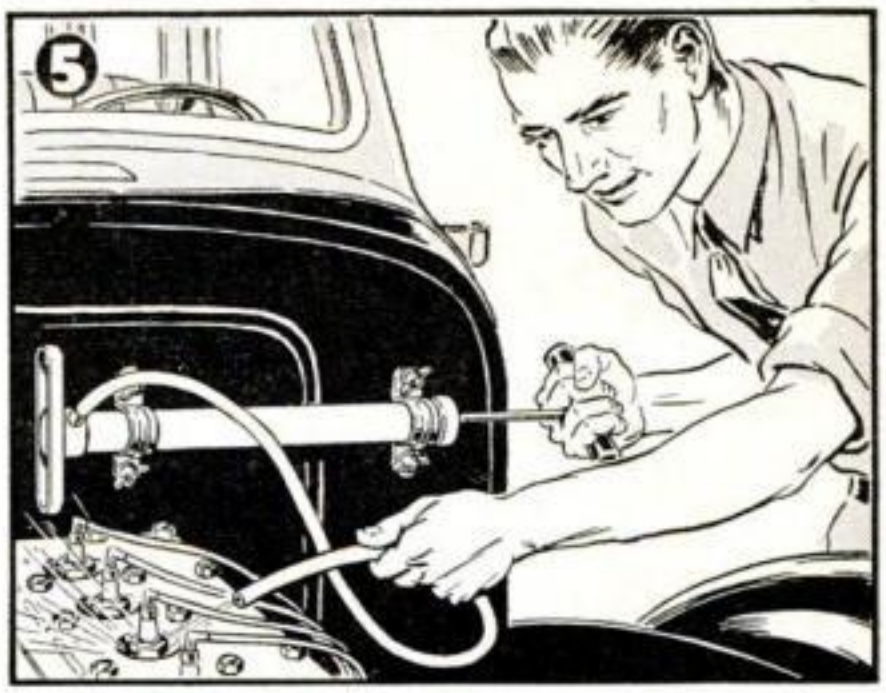
4 TO PREVENT ACID DROPS from the tip of a service-station battery hydrometer from damaging materials on the workbench or around the shop, the hydrometer rack shown in the drawing can be easily made from plywood and hung up on a wall. A five-and-dime-store salt shaker in the bottom holds the rubber tube and catches acid.—O. B. S.





FOR CAR OWNERS

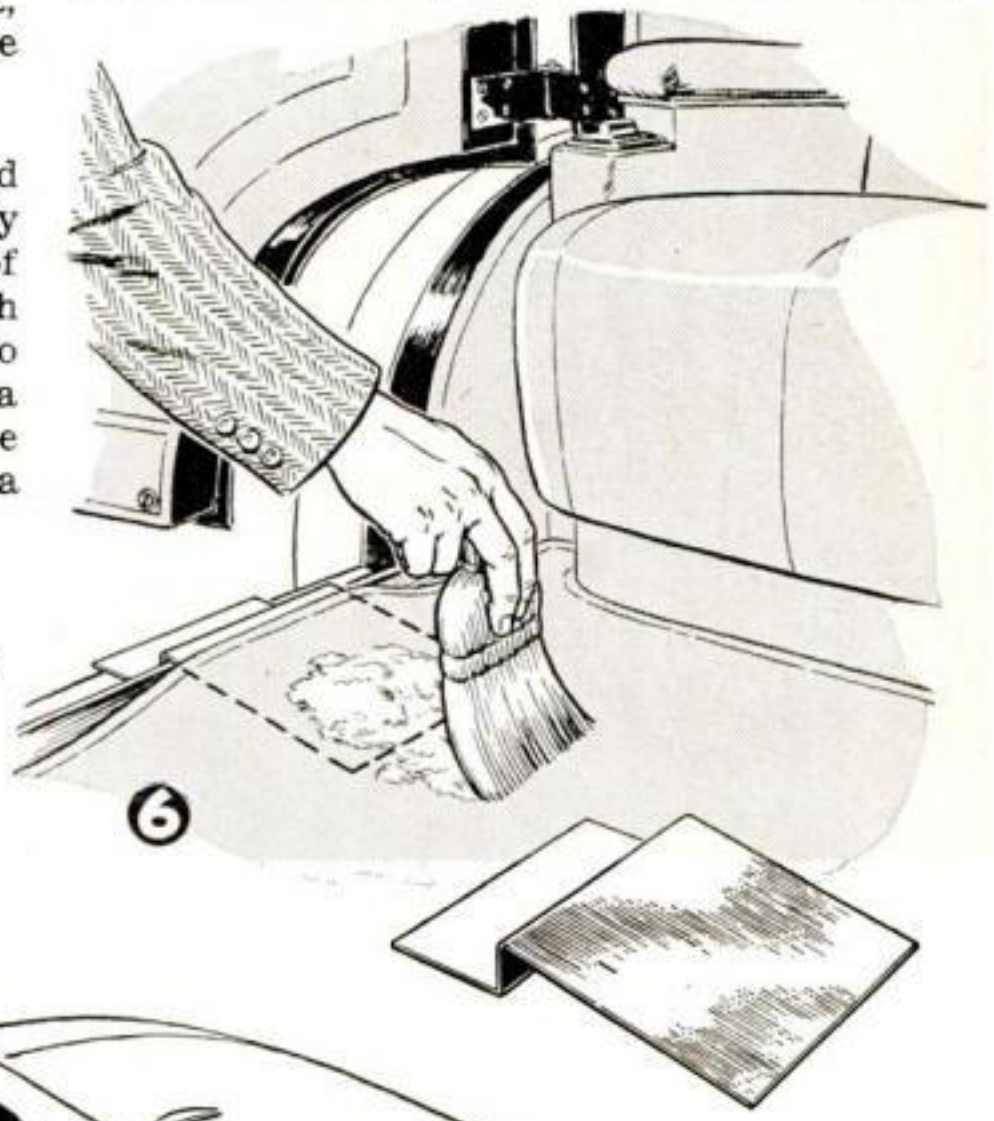
5 AN OLD TIRE PUMP clamped to the dash underneath the hood may frequently come in handy for emergency repairs. It may be used to blow water from spark-plug sockets when rain has short-circuited the plugs, to blow dust from parts of the ignition system, or to blow out clogged gasoline or oil lines. Thumb screws permit removing the pump for inflating tires.—P. A.



6 SWEEPING FLOOR DIRT out of the rear compartment of a car is made difficult by the ledge at the door sill which catches and holds it. A piece of cardboard or of tin, bent as shown in the accompanying sketch and slipped under the edge of the floor mat, raises the mat and permits the dust to be swept over the sill.—S. R.

7 INEXPENSIVE TOP REPAIR on old-style closed cars can be accomplished with ordinary black oilcloth and a quarter's worth of waterproof casein glue. Cut the oilcloth to fit over the fabric top and lap over onto the metal about ½". Apply the glue with a brush, a section at a time, drawing the oilcloth tight as it is laid on. With care, a neat-looking job can be done.—J. D. G.

Drawings by
STEWART ROUSE



Think—OF AN IDEA!

If you would like to let others know about your pet auto tip—and get paid generously for doing so—just write your idea in 100 words or less, draw rough sketches, and send them to the Automobile Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York, N.Y.

"Hey, Doc!" Gus yelled. "Wait a minute! I'm an automobile mechanic, not a psychiatrist!"

GUS chases a jinx

By MARTIN BUNN

JOE CLARK'S voice came from the office of the Model Garage: "Hey, Gus! Telephone!"

Gus Wilson was busy in the shop with a valve-grinding job, and anyhow he dislikes telephone conversation. "You take it," he called to his partner. "Ask 'em what they want."

"No you don't!" Joe shouted. "It's Doc Foley, and he says he wants to speak to you personally."

Grumbling, Gus went to the office phone and said "hello."

Dr. Foley's voice came over the wire. "I'm sending you a new customer, Gus—a man named Fred Conroy."

"Thanks, Doc—we'll take good care of him," Gus said. "Good-by."

"Hey—don't be in such a tearing hurry to hang up on me!" Dr. Foley protested. "This fellow I'm talking about is an unusual sort of customer. For the past couple of months he's been jittering around on the verge of a nervous breakdown. He's a salesman who's working on commission and not making much of a go of it. He has to do a lot of driving, and his car seems to have gotten on his nerves. It makes a half dozen kinds of perfectly fiendish noises. Sounds as if everything's the matter with it. When I asked him why he didn't get it fixed up he said that he couldn't afford to. But don't worry about his bill; he's honest, and if he can't take care of it within a reasonable time, I will. I figure that if you can chase some of those noises it will be a big relief to his frazzled nerves. I think it's an experiment worth making."

"All right, Doc—I'll take care of him," Gus said. "Good—"

"Now, wait just a minute, can't you?" the doctor snapped. "To get him over to your place I gave him a note to deliver to you—he doesn't know what's in it, but you can read it to him. Oh, one thing more. Don't get nervous if he begins to talk a little wildly. He's got a screwy sort of yarn about his engine stopping every time he comes to a traffic light. Well, I guess that's about all. Good-by."

"Hey, Doc!" Gus yelled. "*You* wait a minute! I'm an automobile mechanic, not a psychiatrist! I'm not going to —"

But Dr. Foley had hung up, and when Gus called his number his office nurse said he'd gone out.

Ten minutes later Gus's head was jerked up from his work by an ear-piercing shriek of brakes, and he saw a small and shabby sedan come to an abrupt stop just outside the open shop door. It started jerkily again with the whine of a slipping clutch, and stopped inside the shop. A nerve-torturing squealing came from under the hood.

A tall, thin man who was crouched tensely over the steering wheel straightened himself up and got out of the car. Gus noticed that

he was middle-aged and unprosperous looking, and that he blinked at him nervously. "You Mr. Wilson?" he mumbled as he produced an envelope from a coat pocket. "I've got a note for you. Dr. Foley asked me if I'd drop it off here."

Gus took the envelope. "Switch off your engine, why don't you?" he said. "Maybe there's an answer, and . . . Quite a squeal you've got under that bonnet."

Fred Conroy reached into the car and turned the ignition key. "That noise is driving me crazy," he said gloomily. "There's something almighty wrong with my motor, but I can't—I don't feel like letting myself in for a big repair bill right now."

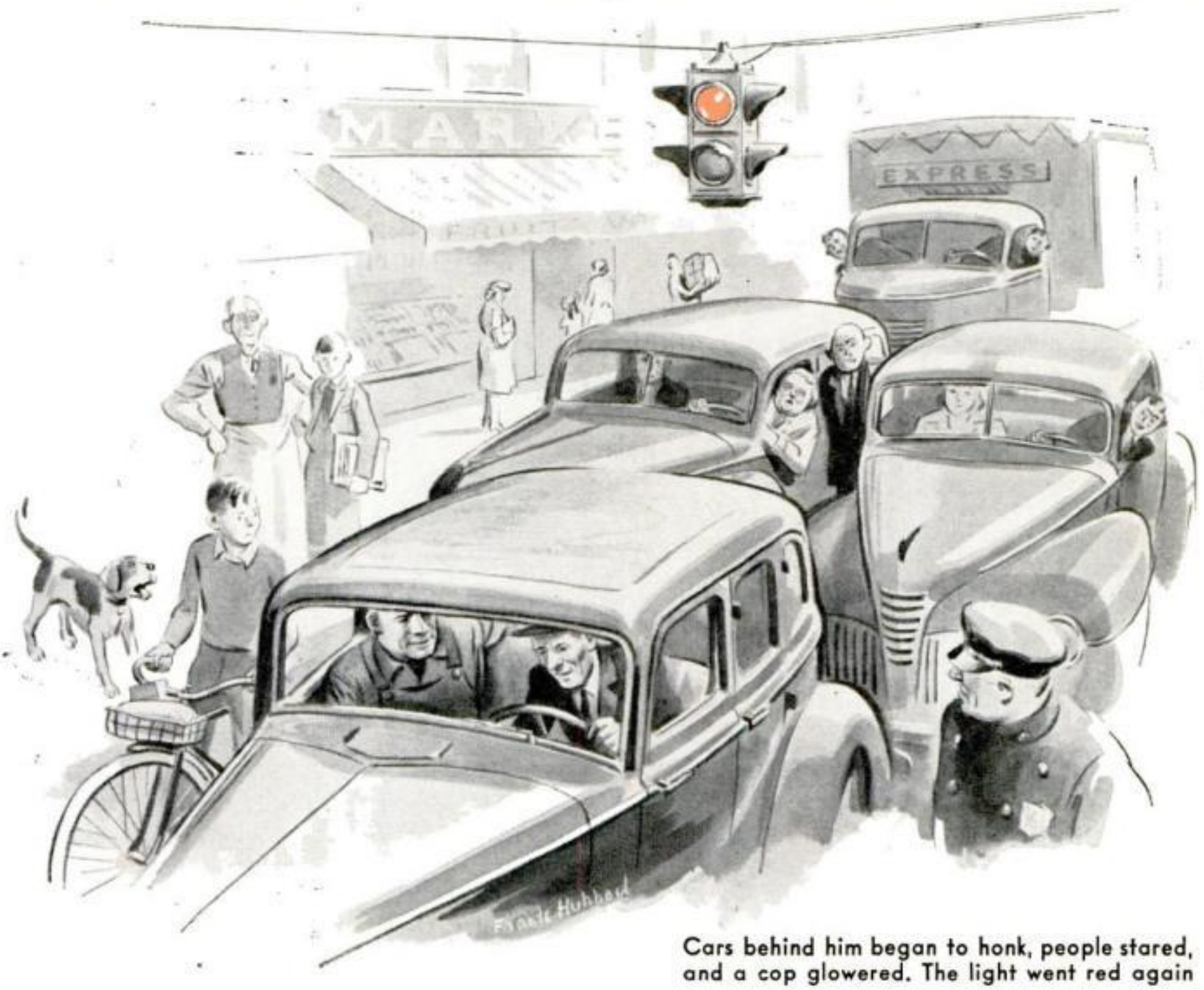
Gus went over to the car, raised the hood, and cocked his head as he listened for a few seconds. "Sounds bad, but it doesn't mean a thing," he decided. "So far as that squeal goes, there's nothing wrong with your engine. The noise is made by your fan belt being glazed and is amplified by the metal hood. Fixing that up won't take five minutes. Well, let's see what Doc Foley has to say."

Gus read the short note, and grinned. "He says that your car needs to have a few odd jobs done on it, and that by doing them I can help your nerves more than he can," he reported. "Maybe he's right, at that—and car noises sure can get you down. Why, I remember one time when—"

He waded into a long yarn about a hard-to-locate car noise which once had made life miserable for him. Conroy became interested, and soon seemed more at ease. Gus finished his story, began to talk about Conroy's car, and slipped in a hint that there wouldn't be any great hurry about his taking care of the bill for what a good overhaul would cost. "Your brakes need adjusting," he said, "and your clutch needs a little attention. Then while I'm at it I might as well . . ."

Conroy interrupted him. "There's something else," he said, and looked around to make sure that he wouldn't be overheard. "Whenever I tell anyone about it they look at me as though they think I'm crazy. But it's true! Almost every time I come to a traffic light *my motor stops dead!* I suppose you think I'm nutty, but if you don't believe me, take the car out and see for yourself!"

Gus used loading and lighting his pipe as an excuse for doing thirty seconds of hard thinking. "Ever had any trouble with your



Cars behind him began to honk, people stared, and a cop glowered. The light went red again

engine stopping *except* when you come to a stop light?" he asked.

"Sometimes," Conroy told him. "Very seldom. But it nearly always goes dead when I have to stop for a light. They're a blamed nuisance — half of them aren't needed. They get my goat!"

"Well," Gus said soothingly, "let's go for a little ride in your bus. Suppose I drive."

Gus got into the driver's seat. "Sort of cramped behind this wheel, aren't you?" he asked.

"Yes, but what do you expect me to do about it?" Conroy snapped. "Go out and buy a new car because this one hasn't quite enough leg room for me?

"You don't need to buy a new car—not when this one has an adjustable driver's seat," Gus told him good-naturedly. "Slide the seat back to where it's comfortable—and being comfortable counts when you have a lot of driving to do."

Conroy's thin cheeks flushed. "I'm just dumb," he said in a discouraged voice. "I never noticed that the seat is adjustable. It's just the way it was when I bought the car three years ago! I don't know how it is, but I never seem to . . ."

"Forget it," Gus advised him. "We'll adjust the seat when we get back. Now let's go out and get to the bottom of this stop-light mystery."

He started the engine and was rather surprised to find, the car ran well enough—except for noises.

There's a stop light at an intersection a mile from the Model Garage. Gus slowed down, and stopped. The engine kept on running.

"Oh, once in a while it'll keep going," Conroy said. "But nearly always it goes dead. You'll see."

There's another light half a mile down the road. Again Gus slowed — with a shriek of brakes — and stopped. And again the engine kept on running.

Conroy looked disconcerted. "It'll do it for you, but it won't do it for me," he said. "I tell you, there's something—" His voice trailed into somber silence.

Gus drove on for a couple of blocks, then swung the car around and pulled in at the curb.

"You try it now," he said. "Forget about me. Drive exactly the way you do when you're alone."

They changed seats, and Conroy drove back the way they had come. When they came to the traffic lights he put on his brakes hard, threw out his clutch roughly, and came to a jerky stop. The engine kept on running. But as he restarted the car the engine stopped.

"All right—start her up again," Gus said. The starter ground away for perhaps ten seconds, then the engine caught.

A few minutes later the other light came in sight ahead of them. As they came up to it Conroy again kicked on his brakes, threw out his clutch, and came to another of his jerky stops.

And again, as he restarted the car, the engine stopped.

Cars behind him began to honk, people stared, and a cop glowered at him. The light went red again before he could start his motor.

He pounded the steering wheel with his fist. "I can't stand any more of this!" he shouted. "It's driving me nuts, I tell you! There's a jinx on me!"

"Take it easy—take it easy," Gus said. "I've found your trouble and it's a laugh—nothing at all to worry about. Go ahead now, and when we're across the road pull into the curb. Then I'll chase that jinx for you."

Conroy did as Gus told him. "Leave the engine running, and slide over so that I can get behind the wheel," Gus directed as he got out. He walked around the car and got into the driver's seat. "Now watch," he said. He pressed the clutch pedal down to the floor boards, and then gently shifted gears—into first, second, and high. "That's how *I* do it," he said.

"It's how I do it, too," Conroy said.

"Not exactly," Gus qualified. "Watch again."

He threw the clutch out, then jerked the gear shift into first, into second, and—

The engine stopped.

"See?" Gus asked.

"No, I don't see anything, except that the motor has quit," Conroy said.

Gus laughed. "While you were driving I noticed that you put a good deal of force into your gear-shifting. When you restarted after stopping for that first light I noticed that just as you shifted into second the engine stopped. I couldn't see why, but at the next *(Continued on page 210)*

GUS SAYS:

When a driver kicks about his gas mileage even though his car is in good shape, the trouble is usually to be found in him! Either he guns his motor on starts, or fails to keep an even pressure on his foot accelerator out on the highways. Both these mistakes waste gasoline!

HOME *and* WORKSHOP

Fig. 1. This octagonal table seats eight comfortably. The chairs are shaped to fit under it. All the garden furniture described on this and the following pages can be built entirely with hand tools

Furniture for a Sunny

EIGHT DESIGNS

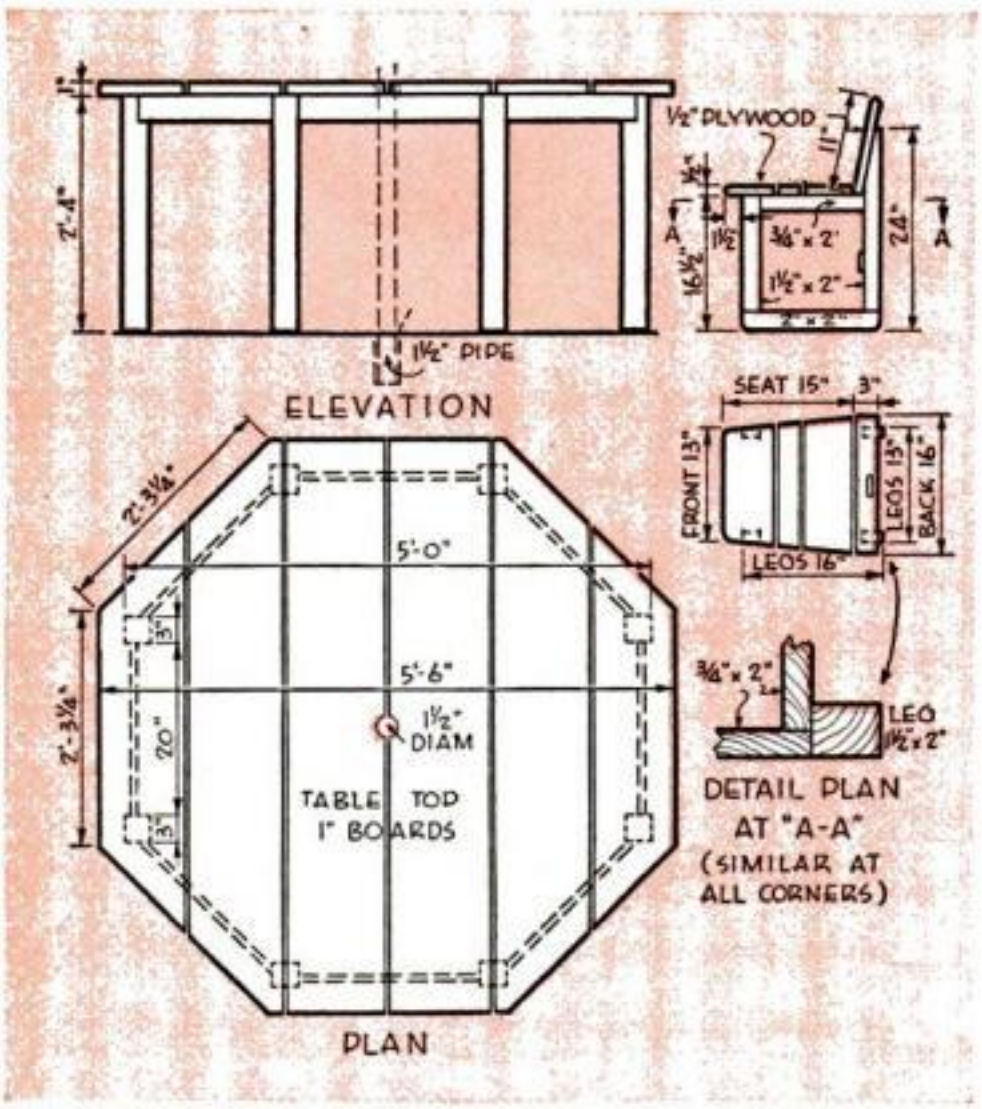
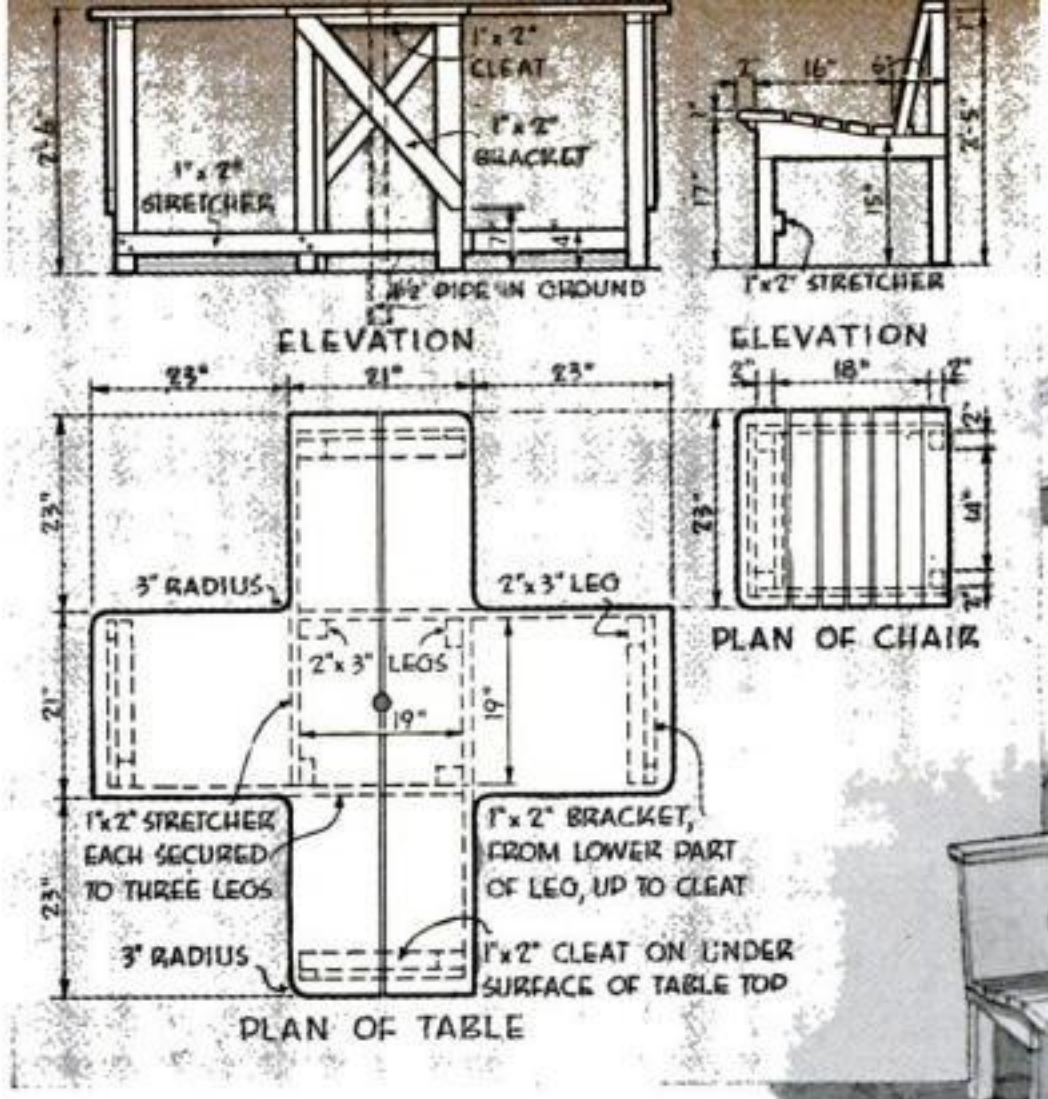


Fig. 2. Dimensions for dining set at top of this page

SUITABLE furniture will make any garden more livable and add much to the enjoyment of healthful hours spent outdoors. The proper garden dining accessories will also supplement a barbecue fireplace (see P.S.M., June '41, p. 156) from the standpoint of appearance as well as utility.

The eight pieces of outdoor furniture shown in the accompanying illustrations, complicated and expensive looking as some of them appear to be, have been designed so that they can be built in the simplest possible way. All the legs are square, with stretchers nailed or screwed to them.

If the home mechanic wishes to use doweled or mortised joints, the designs may be modified to suit. But the construction shown is well worthy of consideration, because by following it, even the comparatively inexperienced builder should have no trouble in mak-



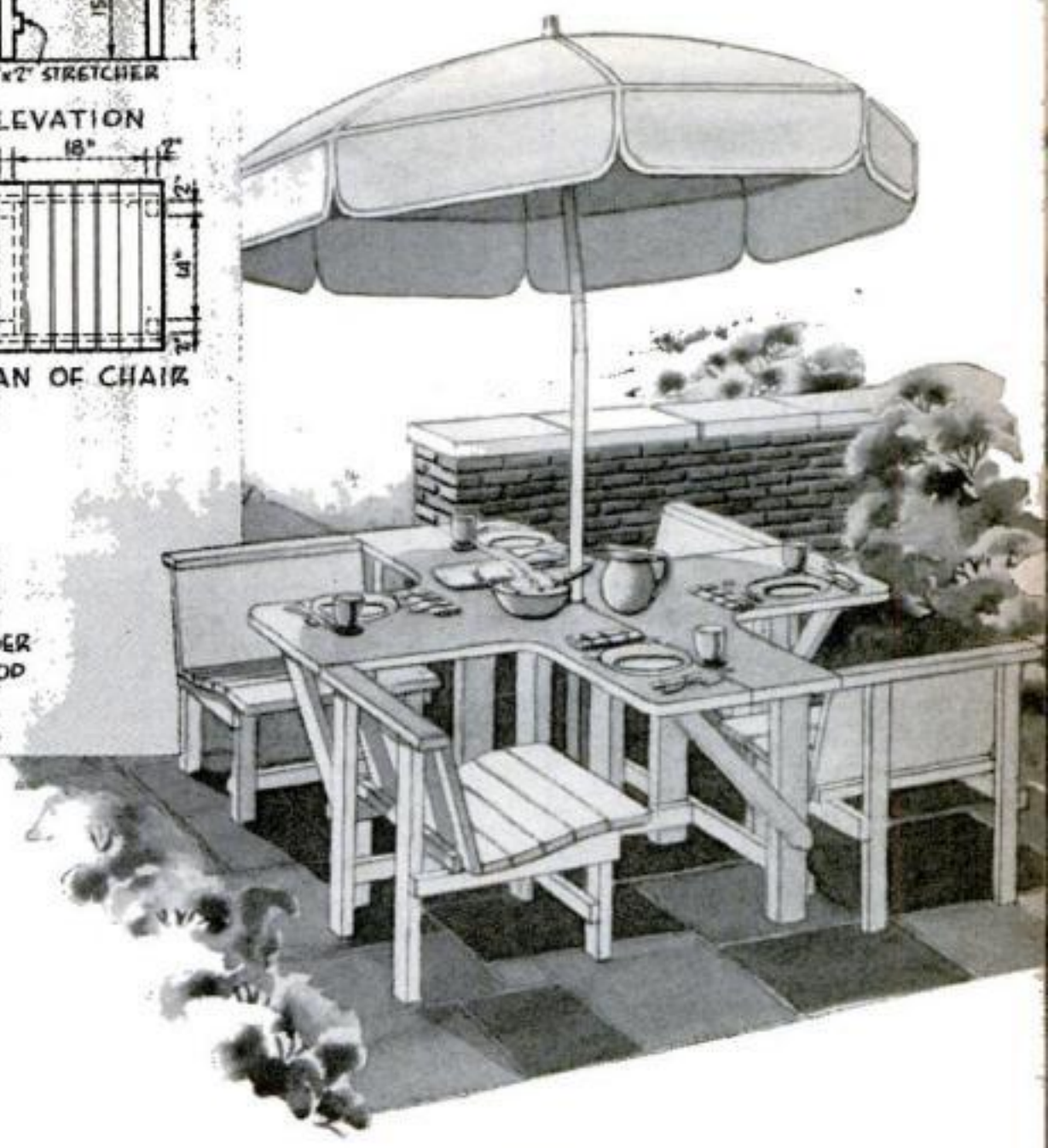


Fig. 3. Really different is this clever design, which gives each diner ample table and leg room. Corners of the plywood panels that form the table top are used for the chair backs. The umbrella shaft fits into a ground socket, which is a piece of galvanized pipe

Outdoor Living Room

BY CARL T. SIGMAN AND WILLIAM J. WARD, JR.

ing attractive, serviceable pieces. No grooving, rabbeting, or careful joinery is required, which makes it entirely feasible to build them with hand tools alone, although power tools will, of course, speed the work considerably.

The only parts that may prove difficult to make with hand tools are the wooden wheels shown on the coffee table and the settee, but the builder may be able to have these made up at a local mill or cabinetmaking shop. They should preferably be of laminated construction. A compromise might be effected, however, by using heavy disk wheels from a discarded toy wagon or scooter. If these are painted to match the piece, such substitution should not prove objectionable.

White pine, which is easy to work, takes paint well, and can be obtained almost everywhere, is an excellent wood for garden furniture if it is properly finished. Cypress, chestnut, redwood, fir, and spruce are all satisfactory, provided that a choice is made with a view to the finish desired. Some woods will not take paint as readily as others, but they can be stained; and certain woods may even be left untreated to weather to a silvery gray. The lumber should in any case be ordered "dressed four sides," and should be free from pitch.

Painted outdoor furniture can add a gay note to the garden, but colors must be carefully chosen. Flowers and shrubbery should provide the dominant color note, and the furniture should be subordinate to these. It is best to avoid using two bright colors on a single piece.

In a colorful garden, furniture painted in two cold colors such as gray and blue may look well. Warm colors may, with proper discretion, be used for trim, but combinations of two warm colors, such as red and yellow or red and brown, may clash in a garden bright with blossoms. White, of course, is always in good taste for outdoor

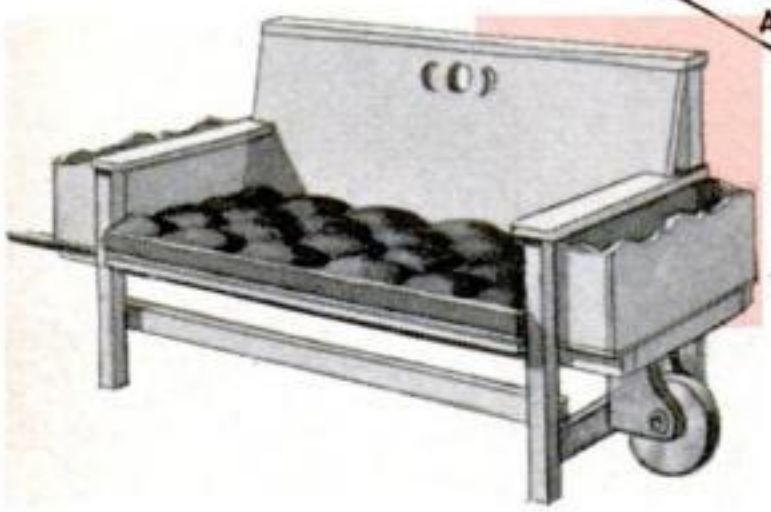
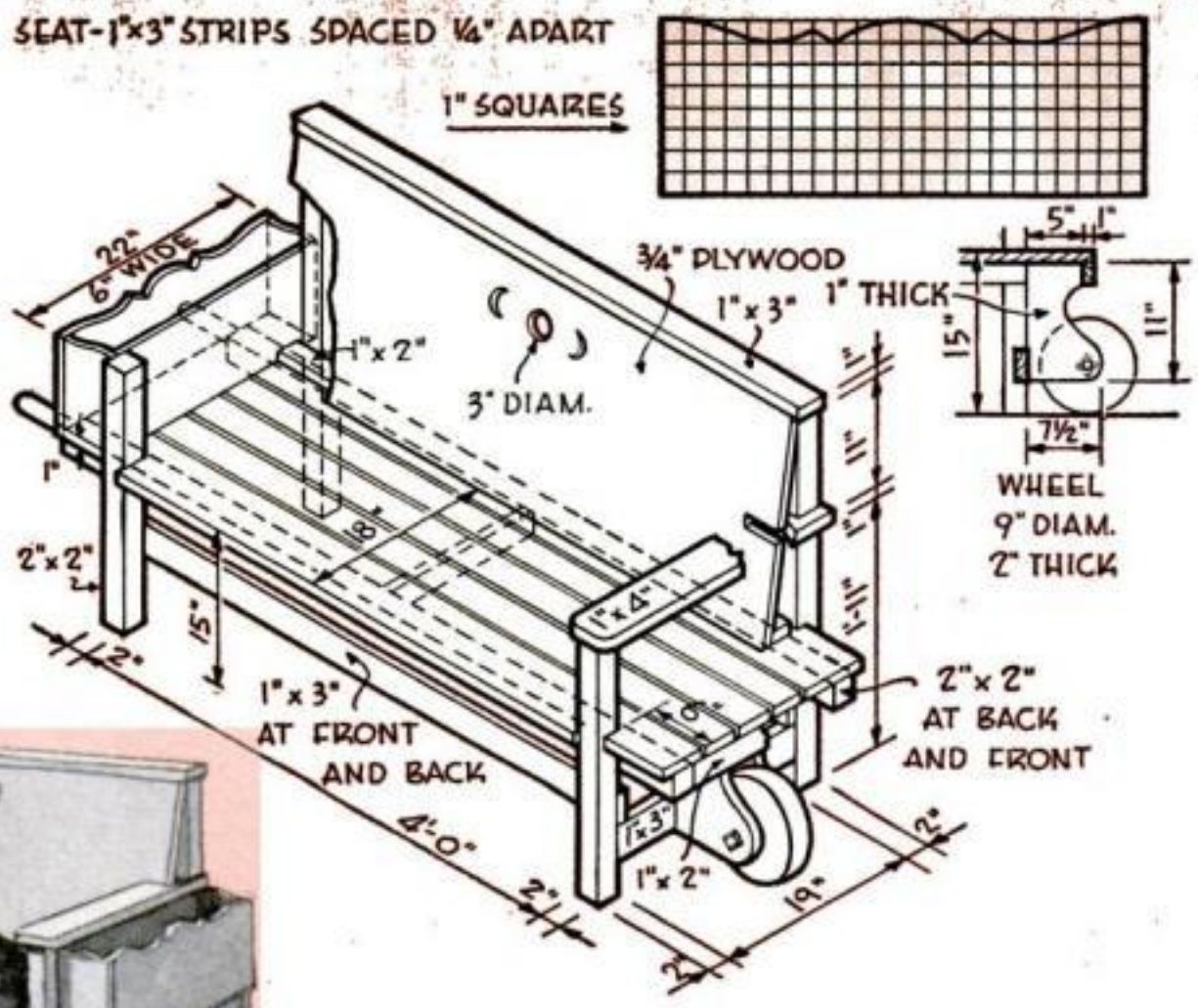


Fig. 4. The seat back of this wheelbarrow settee should be made of waterproof plywood. Thinner pieces of the same material may be used for the two boxes. The seat pad shown is waterproof, and obtainable ready-made in several sizes and colors



use. Green is unobtrusive and serviceable.

From the standpoint of the preservation of the wood, it is well to remember that improper painting may be almost as bad as not painting at all. Outdoor pieces, if made of wood that requires painting, such as white pine, should be finished on all surfaces. If this is not done, moisture is absorbed by the unpainted surfaces and will eventually cause the wood to decay as though it had never been painted at all. The undersides of tables, chair seats, and the like, including the bottom surfaces of legs, should be finished completely with at least two coats of good outdoor paint.

Water is apt to collect and enter at the joints. These are often neglected in painting, but the construction of the pieces shown makes it possible to paint all members and assemble them afterwards. This procedure will afford well-protected joints and make for long life. A final finishing coat may be applied after the piece is put together.

For a large family, or for entertaining, the octagonal table shown in Fig. 1 is ideal. Tapered seats permit the chairs to fit under the table when not in use, and the legs are fitted with runners to make them easier to push or pull about. The entire unit therefore takes up a minimum of space, yet will seat eight persons comfortably.

Space is left between the table-top planks and the strips forming the chair seats so

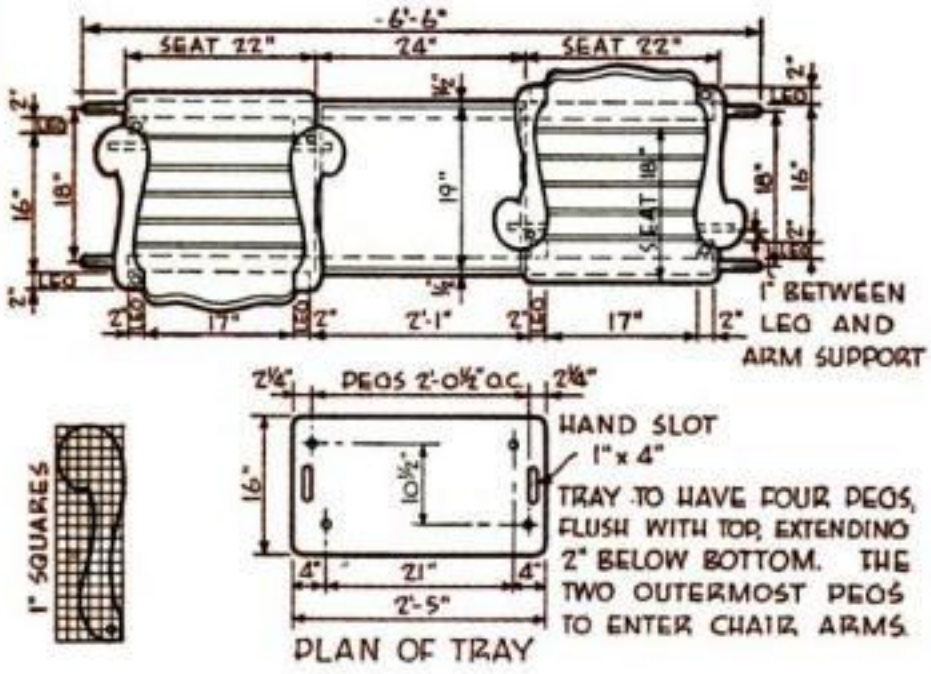
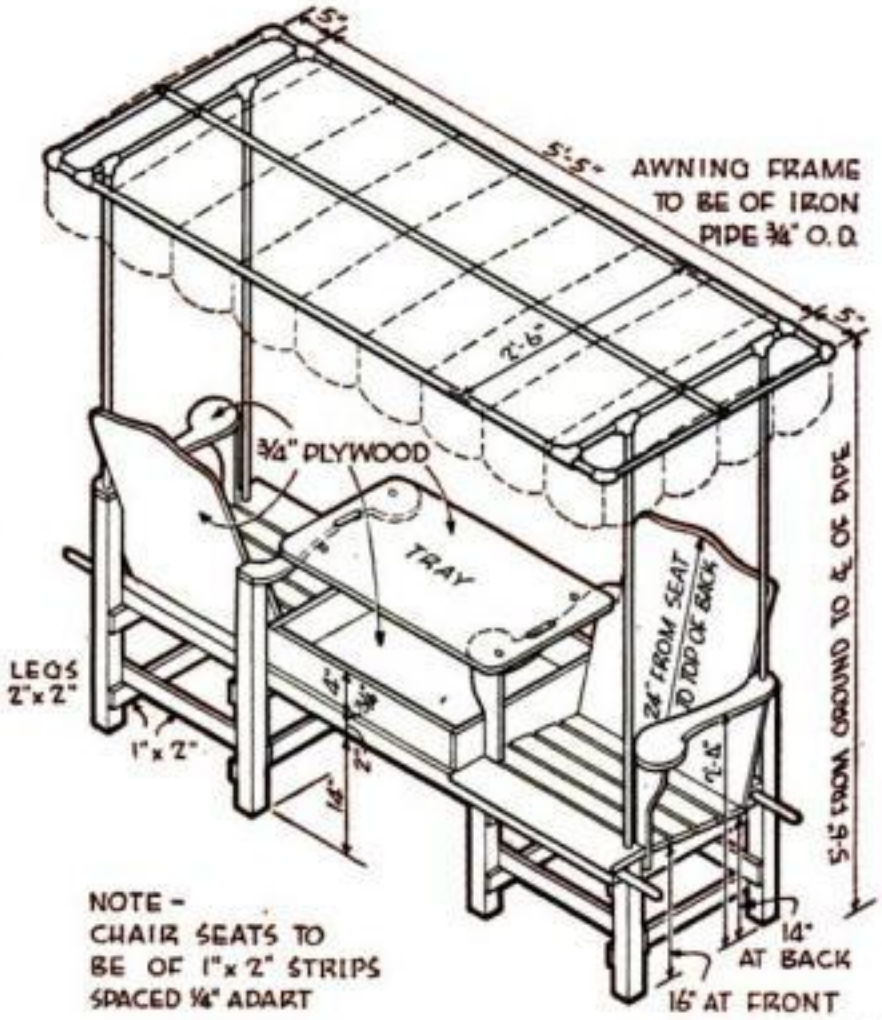
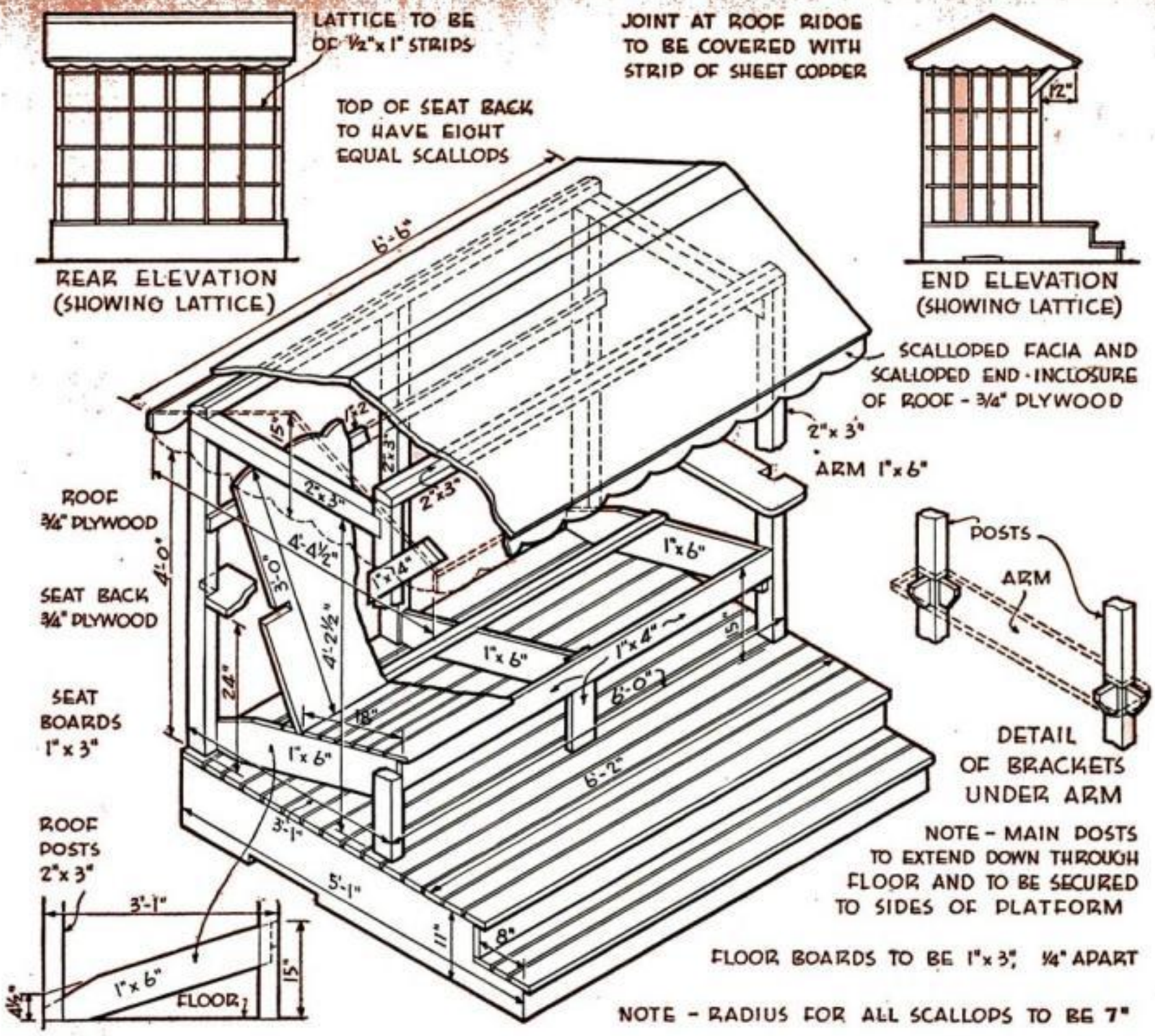


Fig. 5. Rails project at both ends to form handles by which this unit can be carried about. Canopy and framework may be omitted





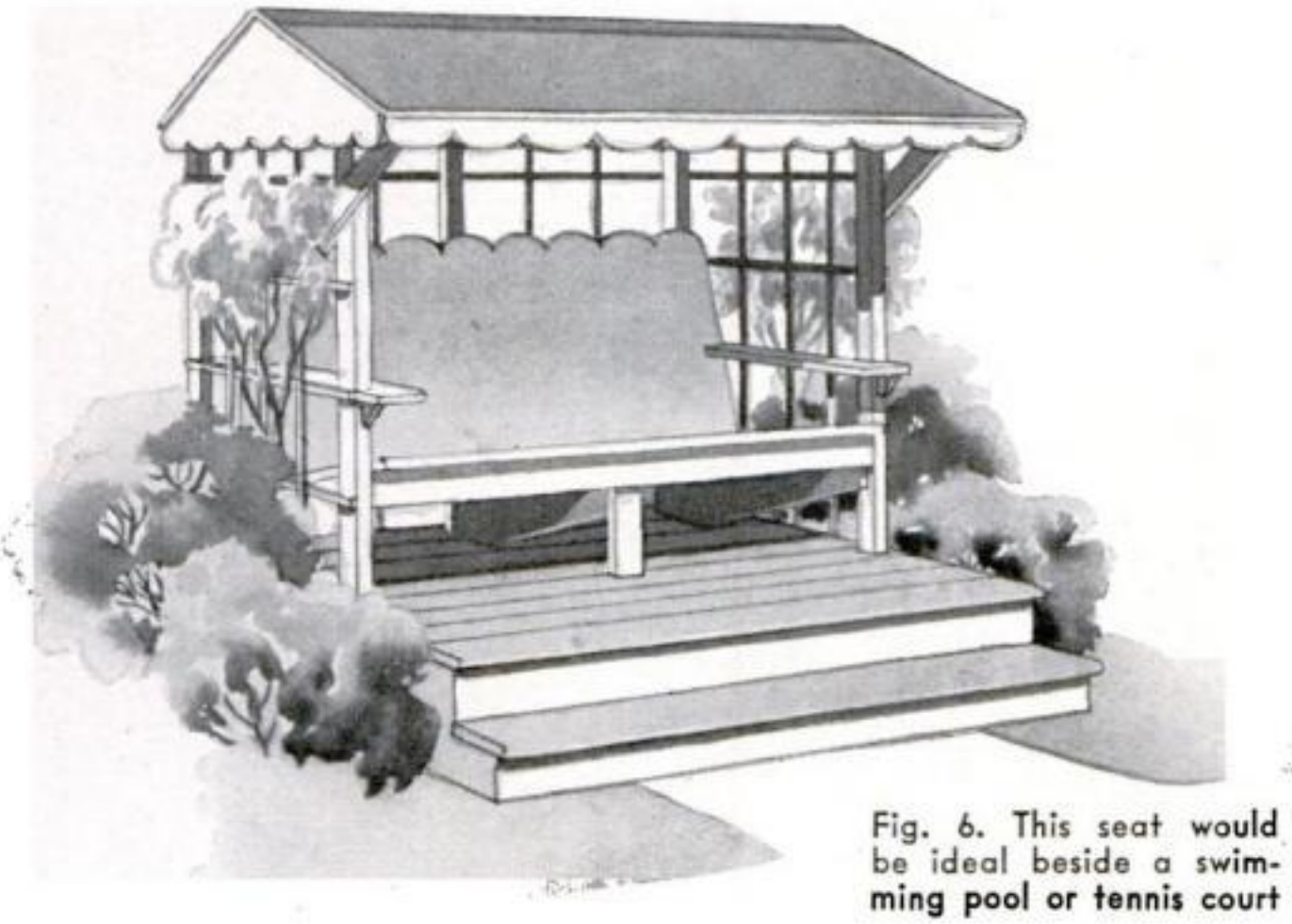


Fig. 6. This seat would be ideal beside a swimming pool or tennis court

Fig. 3. It is designed to seat four persons. The arrangement is so compact that the umbrella affords shade for all, yet each diner has plenty of table space and—equally important—ample leg room. A single leg supports each side of the table. The diagonal brace does not interfere with the diner's comfort.

Two pieces of outdoor plywood are used for the table top, and the cut-out corner pieces may be utilized as the backs of the chairs. Here again the seat strips are spaced a fraction of an inch apart to provide drainage, as that rain water may drain off readily. Chair backs are of waterproof plywood, with a cut-out slot that forms a handgrip. The shaft of the beach umbrella passes through the table top and rests in a socket in the ground.

Especially novel is the suite illustrated in are also the two panels forming the table top. Any other chairs may be used with this table as readily as those shown.

For comfortable lounging in sunshine or shade, the wheelbarrow settee shown in Fig. 4 has much to recommend it, for it can be rolled about to take advantage of the best

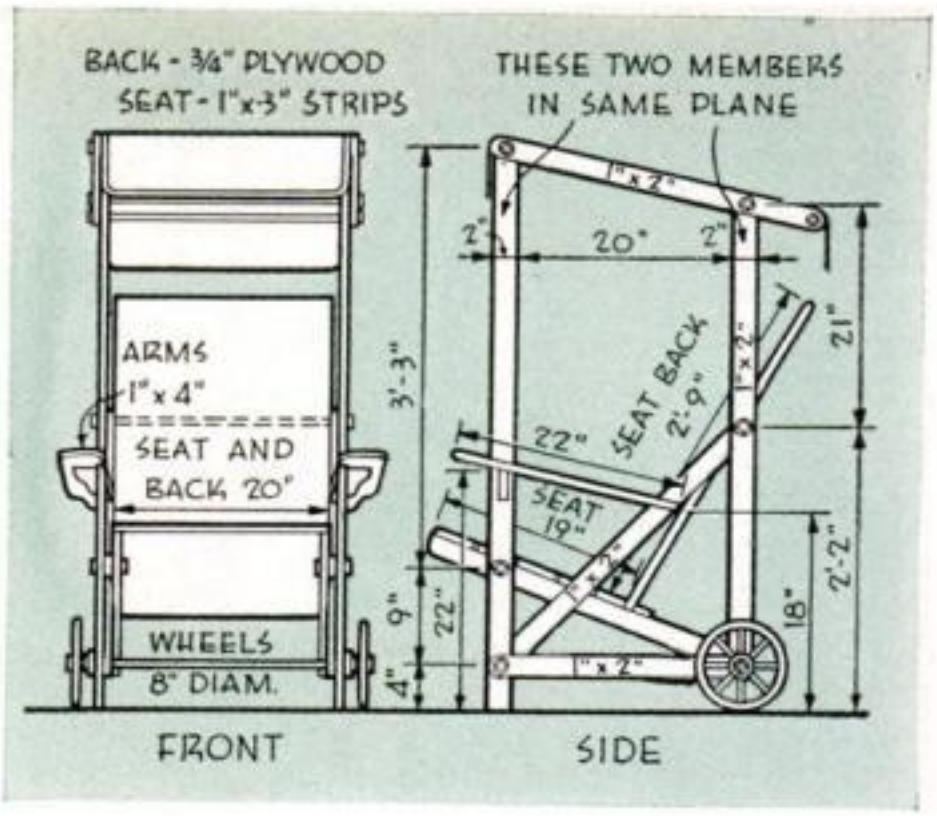


Fig. 7. Triangular bracing makes this rolling garden chair strong and light. If the canopy feature is desired, extend the four vertical members as shown, notching the arms for the two front posts

locations as the sunlight changes. The 2″ by 2″ supporting rails are extended beyond both ends to carry two bins or boxes, in which may be kept sewing, magazines, books, or other articles. The boxes may, if desired, be lined with copper to hold living ferns or flowers. At one end the rails are allowed to project 6″ beyond the box, and rounded to form handgrips.

The *tête-à-tête* seat shown in Fig. 5 and on page 137 accommodates two for dining outdoors. The tray has four pegs which serve as feet when it is set upon a flat surface, or hold it securely upon the arms of the chairs. Below the tray is a convenient bin for which a multitude of uses will be found. A game board can be placed upon the tray.

The chairs are fastened together by 2″ by 2″ rails, which project at both ends and are rounded to afford handgrips by which two persons can carry the unit about. The pipe framework and canopy are optional. Ordinary ½″ pipe, which is a trifle over ¾″ outside diameter, is suitable for the framework. All four vertical supports should be set into holes at least 5″ deep bored into the 2″ by 2″ chair legs. The two outer ends of the canopy frame are bent slightly so that the center pipe, or ridge support, will be a trifle higher than the sides. This will cause the canopy to shed rain water.

The curved arms and front arm supports shown are easily cut out on a band saw. They can also be cut by hand with a compass or coping saw, or simplified to a rectangular shape, with rounded corners.

The usual garden seat is likely to be so situated that little of the garden can be seen from it. Often it is too low. The seat illustrated in Fig. 6 is high enough to afford a good view of the garden, or might be built beside a tennis or badminton court to provide seats for onlookers and a resting place for tired players.

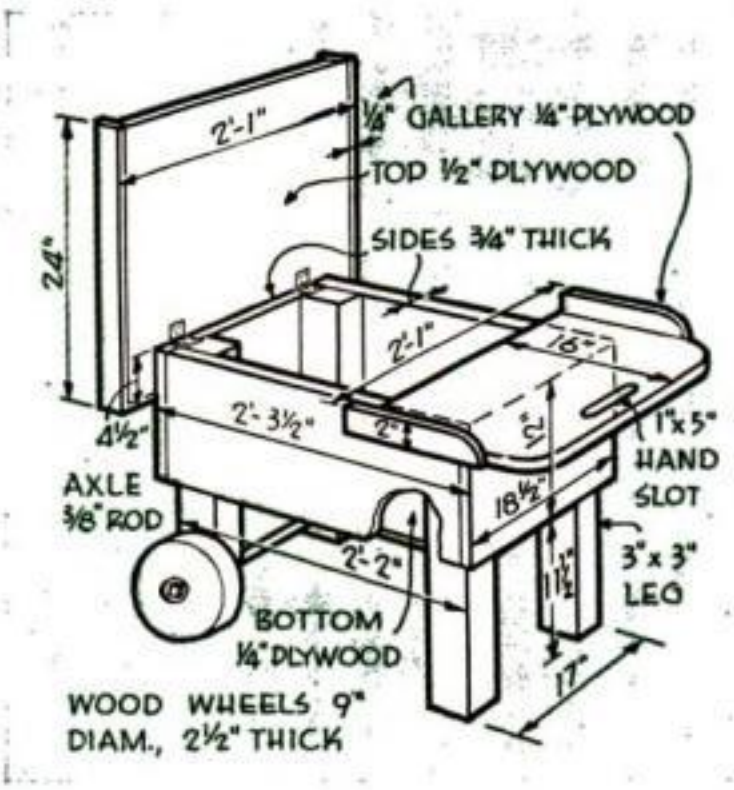


Fig. 8. The top of this unique rolling coffee table lifts to disclose a roomy storage space

The floor boards are spaced for drainage. All five main posts extend through the floor and are nailed to the platform sides. The seat is formed of strips, and tilts backward at a restful angle. Waterproof plywood, ¾" thick, is used for the seat back and the roof. A strip of sheet copper covers the ridge joint. Climbing plants can be trained upon the trellises on the sides and back to screen the seat on three sides.

Constructed upon the principle of the rigid triangle, the chair shown in Fig. 7 is light enough to be easily wheeled from place to place. The important members are 1" by 2". The back, seat, and arms may be made of waterproof plywood, ¾" thick, with waterproof back and seat pads, which can be purchased in various sizes and colors; or wooden strip construction may be used, the pieces being spaced to permit drainage, and pads omitted. The wheel axle and front tie bar are of ⅜" iron rod, threaded at each end. A pair of 8" baby-carriage wheels may be used, or wooden wheels can be made similar to the one shown in Fig. 4.

The use of galvanized nails and brass screws whenever possible for all work exposed to the weather is strongly recommended. Nailheads should be sunk below the surface of the wood, and puttied after the first or primer coat of paint has been applied.

If the builder does not wish to paint the parts before assembling them, an alternative method of protecting the joints is to coat each with thinned white lead before nailing it. At least one primer coat and two coats of a good quality outdoor paint should be given the finished pieces. In case an enamel finish is preferred, apply one coat of enamel undercoater and one or two coats of high-grade enamel of a grade suitable for outdoor use.

The legs of the tables and the main posts of the garden seat may be made longer and sunk below ground if this method of installation is preferred. If this is done, the lower ends must be thoroughly creosoted to prevent rot, and the creosote coating should extend above ground level.

Figure 8 shows a quaint but entirely practical rolling coffee table. The top is made of two pieces of ½" plywood, and one panel is hinged as a lid over the roomy storage bin, in which may be kept books, cigarettes, refreshments, and a multitude of other articles. The fixed panel has a cut-out slot, which permits the table to be moved about with one hand. Wooden wheels are especially suitable on this piece, but small disk wheels can be substituted if desired.

The tray stand shown in Fig. 9 solves the problem of serving cooling beverages gracefully. It will be found just as useful on the porch or terrace as outdoors. The shelf below is convenient for holding fruit, candy, cigarettes, and the like. All wooden parts except the legs are of ¼" plywood. The handle is strap iron, with two pieces of dowel bolted to it to form a rounded handgrip. A flat iron strip underneath the tray bottom, to which the handle strip is bolted, serves to distribute the load. The curved sides can easily be cut out with a hand coping saw.

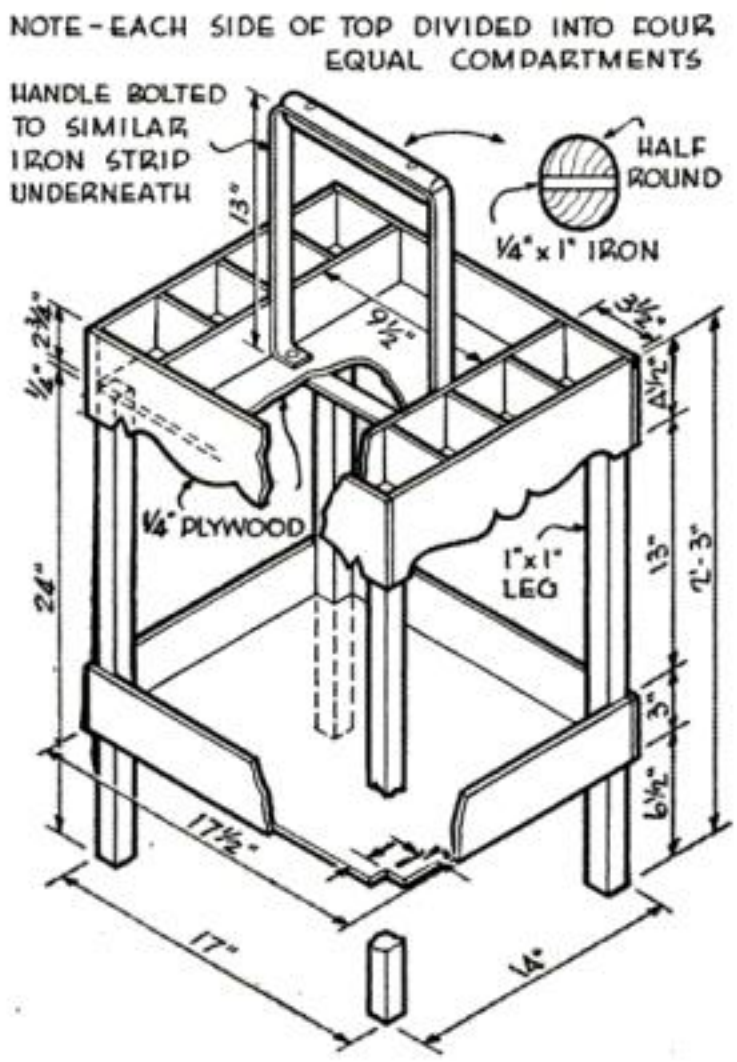
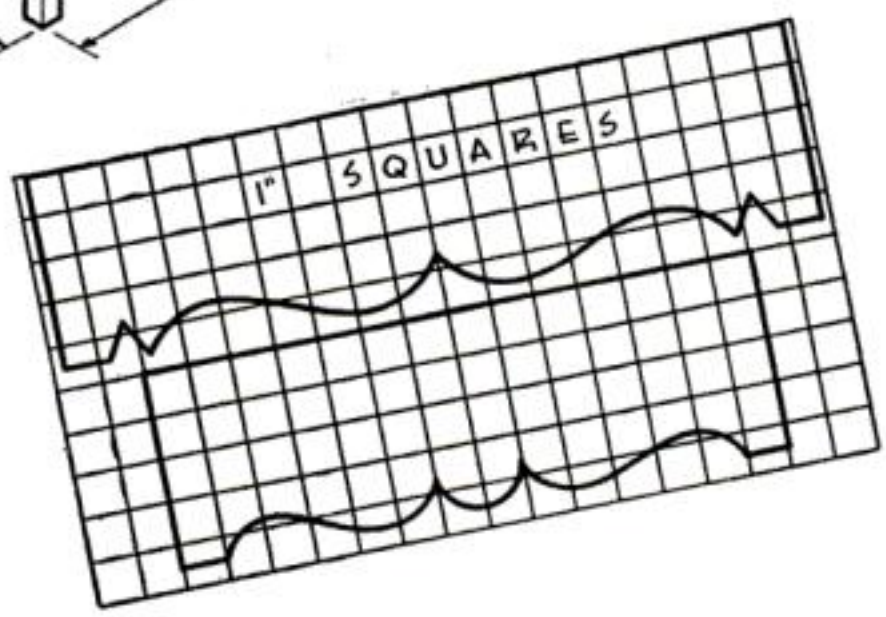
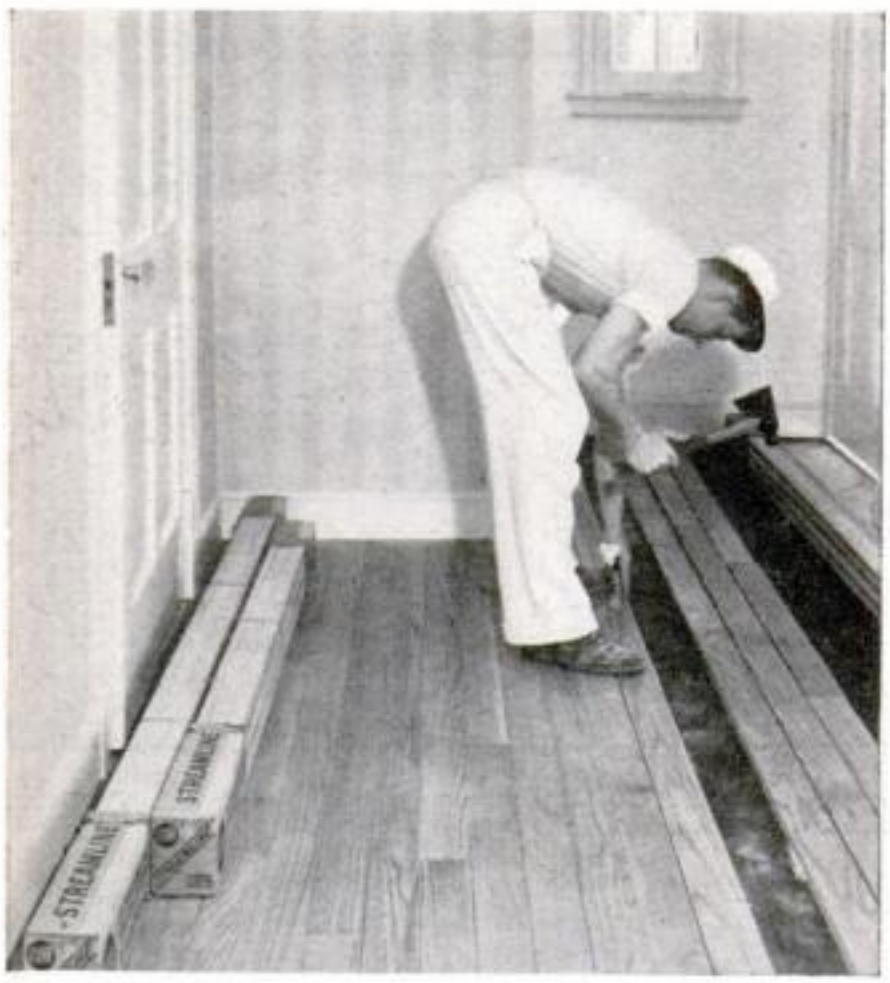


Fig. 9. Eight glasses and a pitcher can be carried at once in this convenient tray stand. All parts except the legs are cut out of thin plywood



IDEAS for HOME OWNERS

A PAINT-CAN GUARD which is pressed into place much like a lid makes it possible to pour from the can without spilling, keeps the rim free from paint, and serves as a brush rest, wiper, and holder for the stirring paddle. It is available in two sizes for one-quart and one-gallon cans. Made of polished tin plate, it can be used repeatedly.



BEAUTIFUL HARDWOOD FLOORING that is completely finished, waxed, and even polished, now makes it easy to replace worn floors, and solves a major remodeling problem for the home owner. A penetrating finish that enters the pores of the wood, filler, and wax are applied to the flooring strips by special machines at the factory. Mechanical buffers then rub the surface to a satiny polish. Available in two grades of red oak, white oak, maple, and beech, and in three sizes, it is blind nailed exactly like ordinary unfinished strip flooring, as shown above. The new floor is ready to use at once, and requires only dry mopping and occasional waxing to keep it in good condition.

THIS STREAMLINED WHEELBARROW is so perfectly balanced that a child can handle it. Sturdy all-metal construction enables it to withstand all ordinary usage. The steel disk wheel turns on a ball-bearing axle, and is fitted with a pneumatic rubber tire. The handles are so designed as to keep the center of gravity low, and to minimize the lifting necessary to roll the load. When the wheelbarrow is not in use, it can be stood on end, and therefore takes up little space in the garage or tool shed.

Ball bearings make this wheelbarrow easy to roll

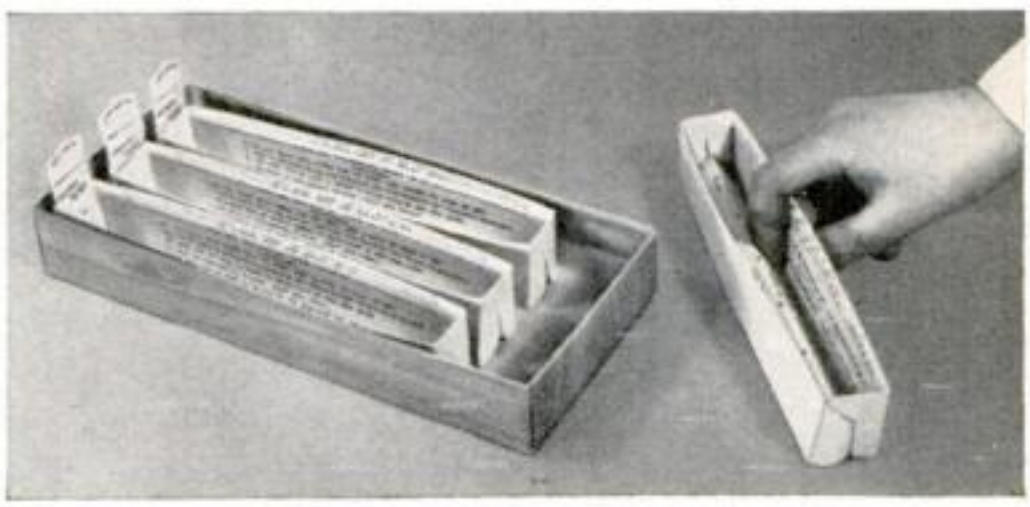
LIGHTWEIGHT DOG STAKE. Guaranteed to tether safely any pet weighing up to 100 pounds, the device shown above consists of an eight-foot chain and a stake, both rustproof, and a sanitary chip-proof pan for food or water. The chain is attached to the stake by means of a swivel, and affords the dog complete freedom within its radius. The pan is detachable so that the stake may be driven into the ground with the foot, and the pan then snapped into place. A surprising feature of the outfit is its lightness, the stake, chain, and dish together weighing only about one pound.

MULTI-PURPOSE GARDEN TOOL. Made of heavy-gauge steel, the tool shown below can be used for several purposes throughout the gardening season. In transplanting, it will lift plants without disturbing the soil around their roots, making for quick recovery and fewer failures. It is convenient for both taking up and setting out bulbs, and is provided with markings for gauging planting depths and distances. An ingenious joint permits of taking it apart readily, and the two members may be used singly as trowels. Handles are shaped to fit the hand, and finished in baked red enamel. The blades are heavily plated. With ordinary care the tool should last several seasons.

This transplanting tool removes soil with the roots. Parts can be separated and used as two handy trowels

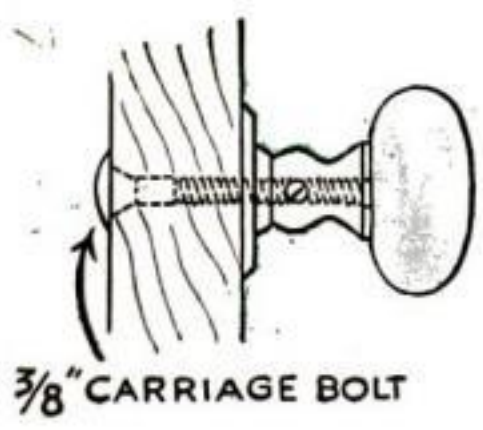
UNBREAKABLE FLOWERPOTS made of a special heavy paper cost far less than ordinary clay pots, and are obtainable in sizes from 2¼" to 5". Seedlings raised in them can be set out, pot and all, eliminating root shock and the usual slow recovery of transplanted growths. The pots eventually disintegrate in the soil. Also at the right, below, is shown one unit of a new indoor seed starter. The complete outfit consists of three such waterproof boxes, each fitted with four seedling trays. These are marked with guide lines showing proper planting depths for various seeds. Because of the design of the units, it is easy to tell when water should be added, and they will hold enough to suffice over a week-end. The outfit will start from 100 to 500 plants, depending upon their size and variety.

Paper flowerpots simplify transplanting. The waterproof indoor seed starter below insures correct planting depth and stimulates root growth by supplying water from beneath

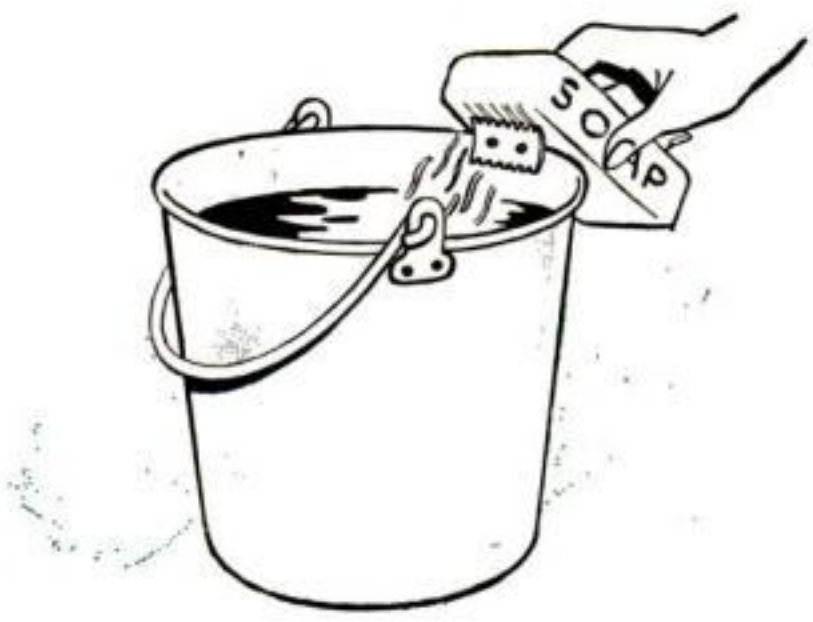


KEEPING

THE USUAL LITTER of making cracker crumbs can be eliminated by putting the crackers into a paper, oiled silk, or cloth bag, folding the top over, and crushing them with a rolling pin. Sift crumbs if necessary to remove any unbroken pieces

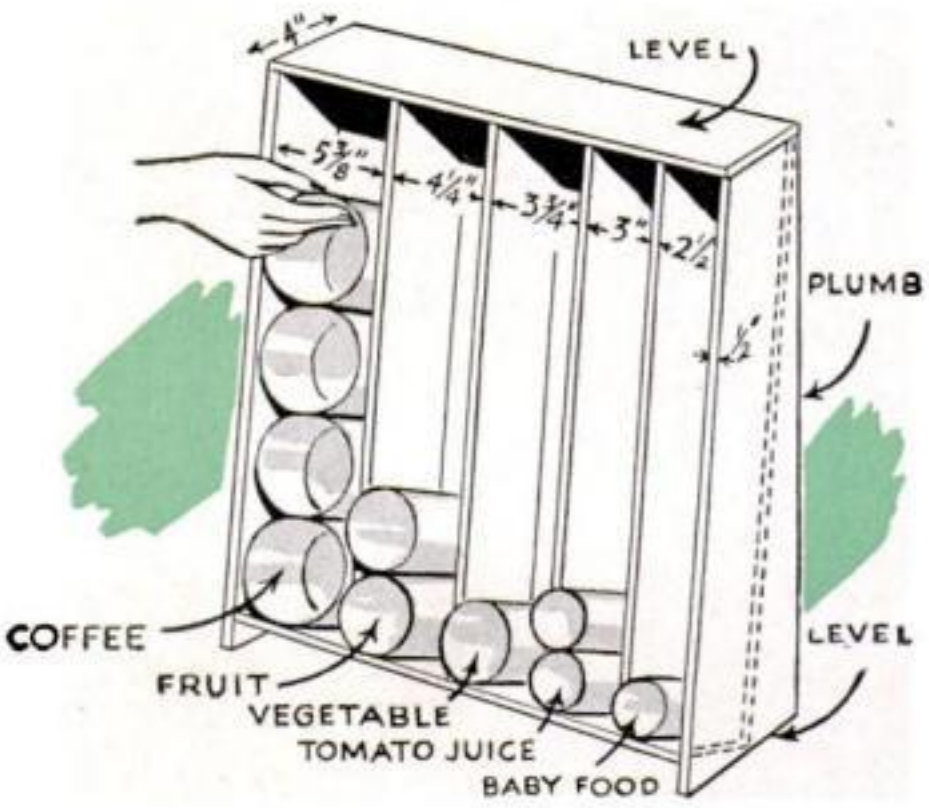


DOOR KNOBS with threaded shanks make convenient pulls or handles for workshop drawers, screen and closet doors, lids, and the like. Fasten each by means of a single long carriage bolt as at the left



AN EASY WAY to shred bar soap so that it will readily dissolve in water is to scrape it against the comb from an old safety razor. This can be riveted or bolted fast to the edge of the scrub pail, where it will always be handy

BY MAGNETIZING your scissors, you can use them to pick up needles and pins dropped during sewing. Simply rub both blades across the poles of a common toy magnet a few times

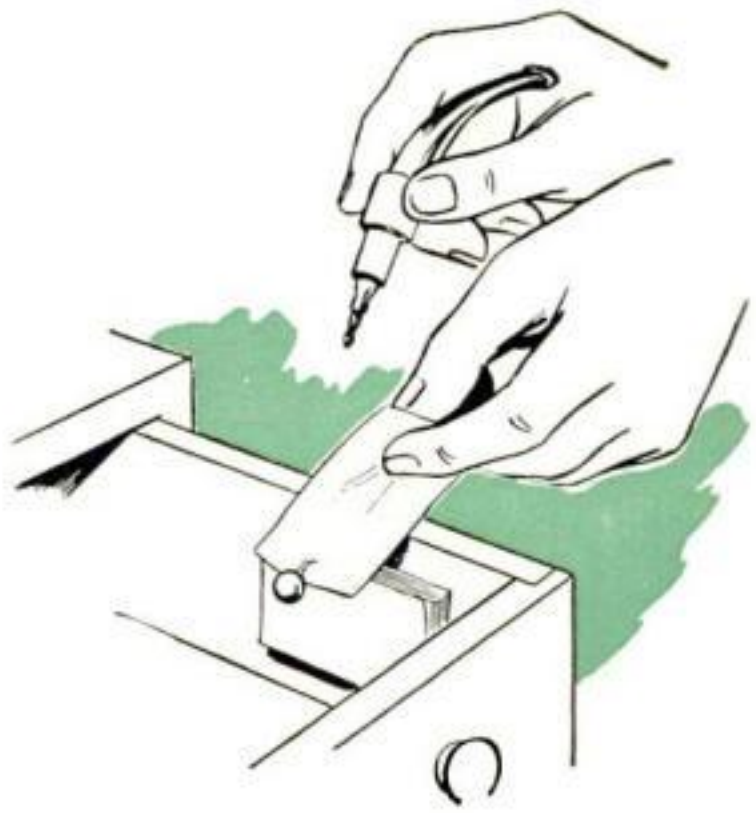


EMPTY TIN CANS for paint mixing and other household or workshop purposes can be kept neatly in the simple rack shown above, which can be quickly made of ½" lumber or wood from boxes

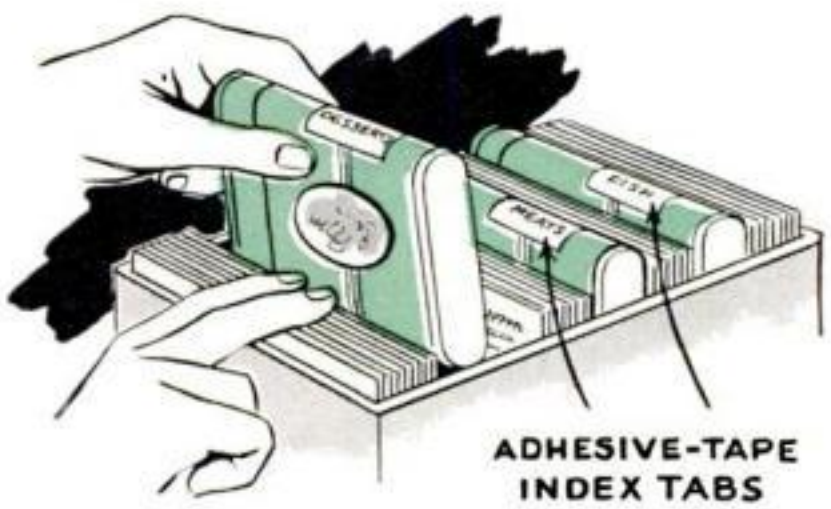
TO PROTECT HOUSEHOLD PETS and wild life from ant poison in bottle-cap form, place the cap in a wire soap holder. Poison set out in this way can easily be dampened for greater efficiency without taking it out of the holder

THE HOME SHIPSHAPE

A LOOSE CHAIR JOINT can be permanently repaired by gluing a thick wood shaving to the dowel. Hold until glue is dry, then sand to a snug fit, apply more glue, and press into place



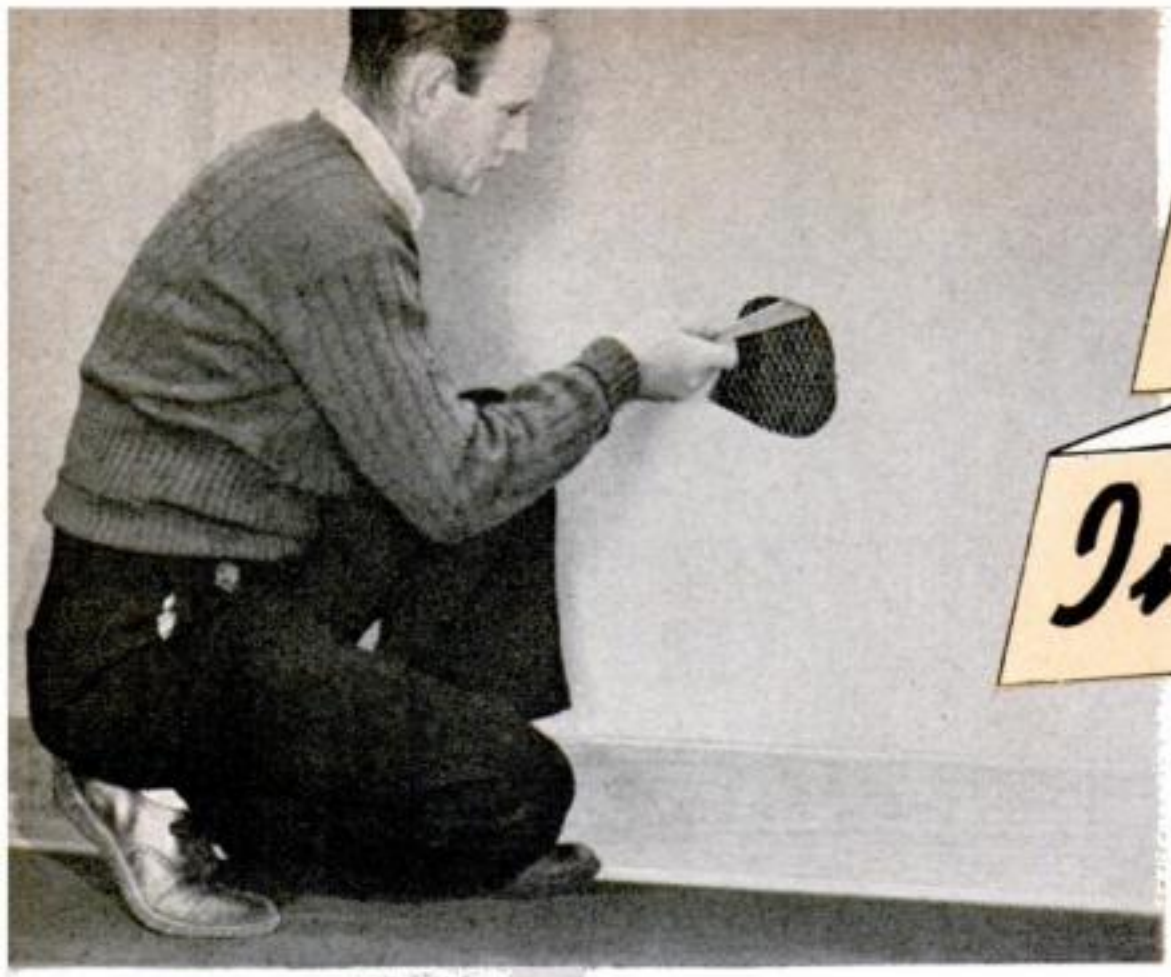
PIPE SMOKERS will find a pad of cigarette papers, fastened with a thumb tack inside the smoking-cabinet drawer, convenient for drying wet pipe stems and cleaning nicotine traps



EMPTY TOBACCO TINS, used as separators in a newly begun card file, will help take up excess space and keep the cards upright. As more are added, the tins may be replaced with index cards

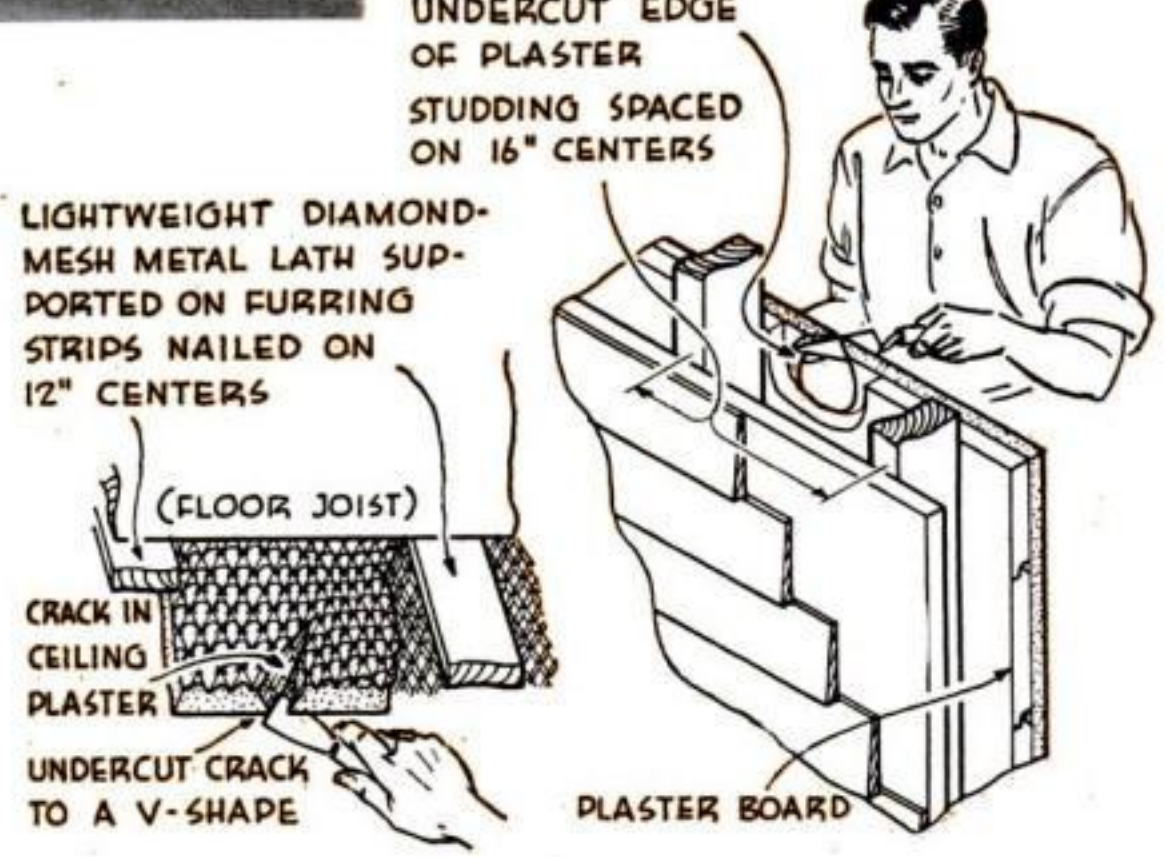
TO INSTALL QUICKLY a tier of light or temporary shelves, nail to the walls ordinary perforated strap iron such as used by plumbers, and bend flattened loops in it at intervals to form shelf supports. Holes in these should be aligned and screws inserted to hold the shelves in place

PORCH PIERS may be built by setting flue tile upon a suitable footing and pouring in concrete, which should be leveled with the top. The smooth outer surface of such tile can readily be painted to suit any desired color scheme



Repairing Inside Walls

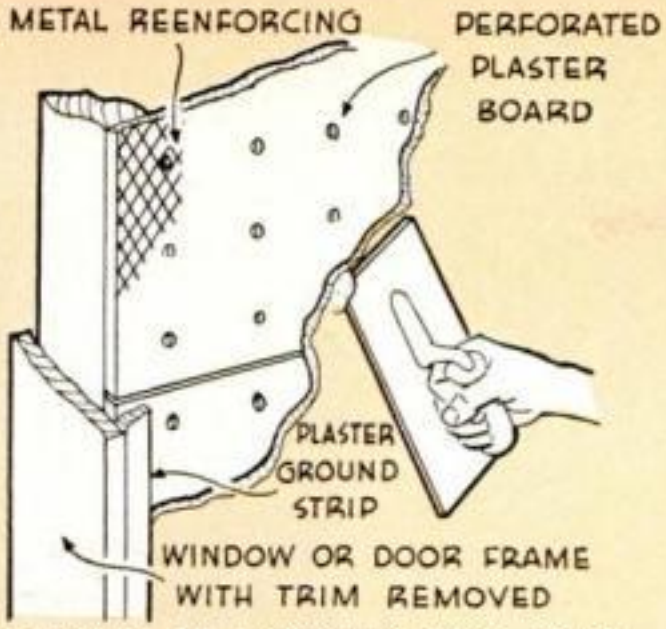
By JOHN MODROCH



INSIDE walls frequently have to be repaired before they can be repainted or papered. It is important not to slight this work, which is not especially difficult or expensive to do. The materials needed and the method of procedure, of course, depend upon the construction of the wall.

With walls of plaster construction, the patching of cracks and holes is the most common repair needed. Fine hair-line cracks and scratches can be filled with patching plaster, which can be bought in powdered form. For this purpose it should be mixed with water to a thin consistency and applied with a paintbrush. Another filler suitable for brushing into very fine cracks may be made by mixing three parts of boiled linseed oil and one part of turpentine.

Deep scratches, dents, nicks, and small nail holes can be filled with thick paste white lead thinned with turpentine to a fairly light paste. Apply with a cloth or a flexible putty knife and wipe the excess paste from the surface. When



1-TROWEL ON A PRIMARY BASE COAT OF PREPARED, SANDED CEMENT PLASTER OR A 1-TO-2 MIXTURE (BY WEIGHT) OF CEMENT PLASTER AND CLEAN SAND. ADD WATER TO SUIT. NOTE: WHEN MEASURING BY VOLUME, USE 1 BAG OF CEMENT PLASTER TO APPROXIMATELY 12 SHOVELFULS OF SAND

2-"SCRATCH" THE BASE COAT WITH METAL LATH OR OTHER TOOL BEFORE IT SETS HARD

3. TROWEL ON A SECONDARY BASE COAT CONSISTING OF A 1-TO-3 MIX (BY WEIGHT) IF CEMENT PLASTER AND SAND ARE USED ALLOW SEVERAL DAYS FOR DRYING

USE A STEEL-BLADED TROWEL FOR SMOOTH FINISH

4- TROWEL ON A FINISH COAT CONSISTING OF PLASTERER'S LIME, GAUGING PLASTER, AND RETARDER

Steps in plastering an entire wall or ceiling appear above and at the right. The finish coat is mixed as shown in a drawing on the following page

the patch is dry, rub it down lightly with sandpaper.

In addition to patching plaster, other prepared powders or so-called "spachtling compounds" are sold for patching, filling, and smoothing purposes. When using any variety that is mixed with water, it is possible to remove the excess from the repaired surface by wiping it off with a wet sponge.

Large cracks and holes should be patched with a plaster rather than a spachtling mixture. Before applying the new material, the opening must be prepared so as to lock the patch in place. The best way to do this is to undercut the old plaster to form a keystone-shaped mold for the patch. Any flat-bladed tool, such as a pocketknife, may be used.

First, however, all loose edges around the hole or crack must be broken off back to sound plaster and the opening dug out down to the lath or plaster-board backing. This can be done neatly and without damage to the surrounding plaster by holding one hand firmly against the surface while breaking off the pieces with a knife. The edges may now be undercut as shown in one of the drawings.

Then dig out the clinches of old plaster from the lath openings, if the plaster is on wire, metal, or wooden lath. This will allow new clinches to form when the new plaster is applied, thereby strengthening the patch. Where plaster board serves as the plaster base, simply clean out the hole or crack down to the board surface, then undercut

Mix the finish coat as above. If it is to be very thin, it must be applied before the secondary base coat has dried completely

the edges of it to lock the patch in place.

Next, wet the opening thoroughly, so as to prevent weakening the new plaster by the absorption of moisture. Special care in this respect should be taken when patching on wooden lath strips. If these are not wetted before the patch is applied, they may cause the new material to crack and crumble.

Although prepared patching plaster is the most convenient patching preparation to use, a suitable one can be made up by mixing two parts of plaster of Paris (gauging plaster) with one part of hydrated lime. Some glue size may be added if a slow-setting mixture is desired.

For best results the new plaster should be applied in two layers. This lessens the chance of shrinkage. Force the base layer into the lath openings and beneath the undercut edges of the old plaster. Fill the hole or crack to within about $\frac{1}{8}$" of the wall surface and allow the plaster to set. Then apply the second layer.

The same preparations recommended earlier for filling dents and small nail holes can also be used as the outer surface of a two-layer patch. If the wall is to be painted, the make-up of the finishing layer should best suit the type of paint to be used. This can be determined by noting the type of sizing recommended by the paint manufacturer. One or more of its ingredients may then be included in the mix for the finishing layer.

It is also recommended that an unsized plaster patch be brought to a smooth finish with a trowel or similar steel-bladed tool and the patch left unsanded. Sanding tends to produce a porous surface on the patch, which may cause it to absorb more paint size than the rest of the wall surface, resulting in a dull spot.

Stippled effects and similar special finishes can be duplicated by going over the patch with a stiff brush, a piece of carpet nailed to a block, or other suitable tool, before the plaster sets. If a patch must be colored to match the wall, dry colors, sold for the purpose, can be mixed with the plaster. Fine or coarse sand, as required, should be added for duplicating sand-finished plaster.

Exceptionally large holes, caused by the breaking away of slabs of loosened plaster, often call for a complete replastering job. It is advisable to leave this to a professional plasterer. There are times, however, when it may be necessary for a home owner to do the work himself. In most cases it will be found expedient to remove the old plaster and do over the entire wall or ceiling.

New plaster should be applied in three coats, as outlined step by step in the accompanying drawings. The total thickness may vary from $\frac{3}{8}$" to $\frac{3}{4}$", depending on the thickness of the so-called "ground strips" (see drawing) with which the old plaster was laid flush. If the total thickness of the plaster is to be as little as $\frac{3}{8}$", the finish coat must necessarily be very thin, and should be applied over the secondary base coat before the latter has dried out completely. If this is not done, it will be necessary to increase the thickness of the finish coat in order to cover and bond with the base coat. To do a clean job around windows and doors, temporarily remove the trim and carry the new

plaster over to the frame or jamb. True up the wall surfaces after the second base coat has been applied. Fill depressions by carefully adding additional plaster. Level high spots with a straightedge, and finally float to a smooth finish. Tools for this purpose can readily be made from shingles or other smooth, flat boards.

Allow new plaster to dry *thoroughly* before applying oil paint. This may require from several months to a year, depending upon climate and other conditions. Water paints, which allow the plaster to "breathe," may be applied almost immediately.

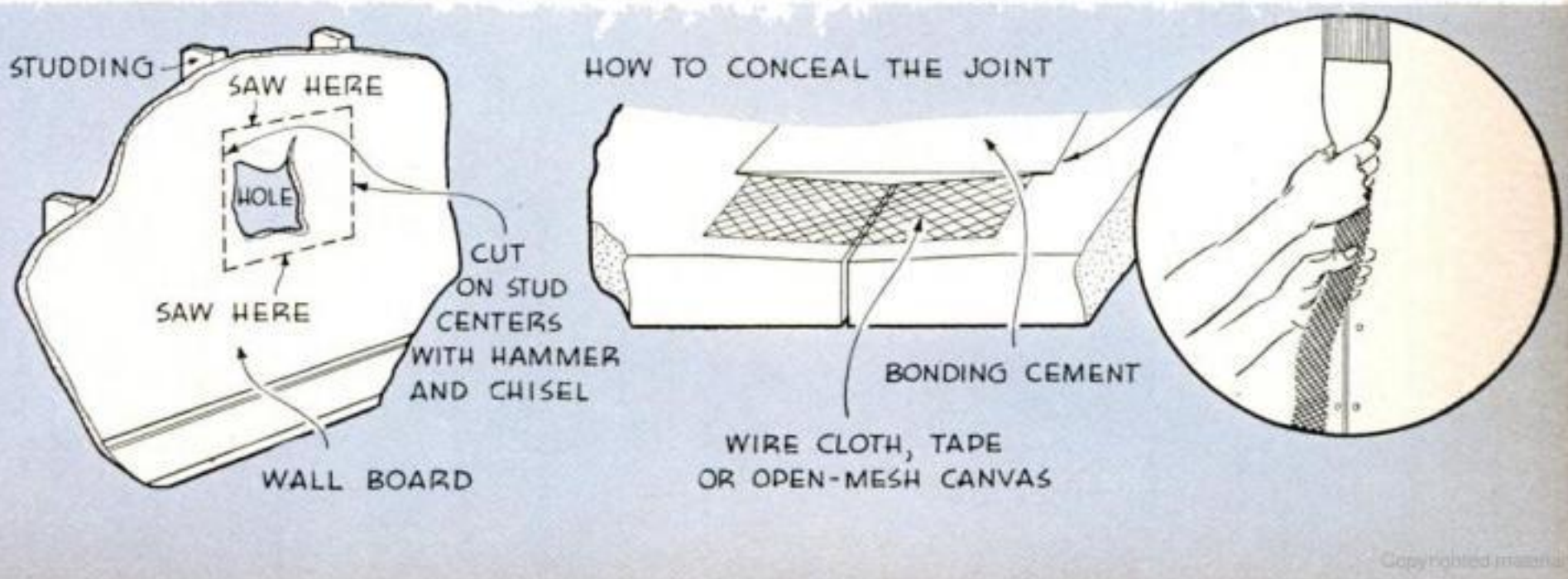
To repair a hole in wall board of the common soft variety, use a patch of the same material. First, enlarge the opening horizontally so as to include the two adjacent studs as far as their center lines. Next, square off the top and bottom limits of the break and insert headers or crosspieces between the studs at these points as shown in the photographs. As their purpose is to provide a sound nailing base, the headers should be cut from 2″ by 2″ or 2″ by 4″ lumber. Fasten them in place with screws, if possible, rather than with nails driven at an angle. Then insert the patch and nail both it and the adjoining wall board to the framing.

To conceal the joint around the patch, the method illustrated in one of the drawings can be used. First, sand down the surfaces of the boards so as to form a slight depression running about 2½″ each way from the joint. Then hold one end of wall-board tape or wire stripping over the joint and use a wide-bladed putty knife to apply the bonding cement recommended by the wall-board manufacturer. Press the cement down through the mesh of the reënforcing material and apply additional cement in order to embed it completely. Work the cement to a feather edge on both sides, and level off the surface.

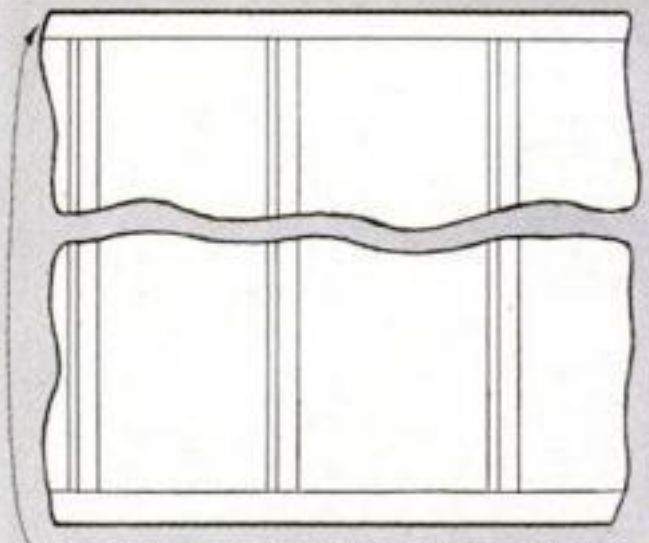
Various kinds of putty and cements are sold as bonding mediums, along with specially made tapes and wire stripping. Certain plastic-paint products are suitable for bonding the stripping over some types of fibrous wall boards. It is advisable, however, to determine by examination the make of wall board under repair and then obtain the materials recommended by the manufacturer. This insures obtaining a proper and permanent bond on the board in question.

Another way to repair a break in wall board is to cut out a whole panel. This will call for the use of panel stripping on the wall, if it is not already paneled. Any decorative paneling scheme may be worked out when the repair is to be handled in this manner. Holes broken through hard-board

To repair a hole in wall board, saw or chisel it out to stud centers, fasten crosspieces between studs, and nail in a piece of the same material. Conceal joints with cement laid over tape or wire stripping



STAIN EDGES OF WOODEN PANEL BOARDS BEFORE NAILING IN PLACE TO INSURE UNIFORM APPEARANCE IF JOINTS OPEN BECAUSE OF SHRINKAGE



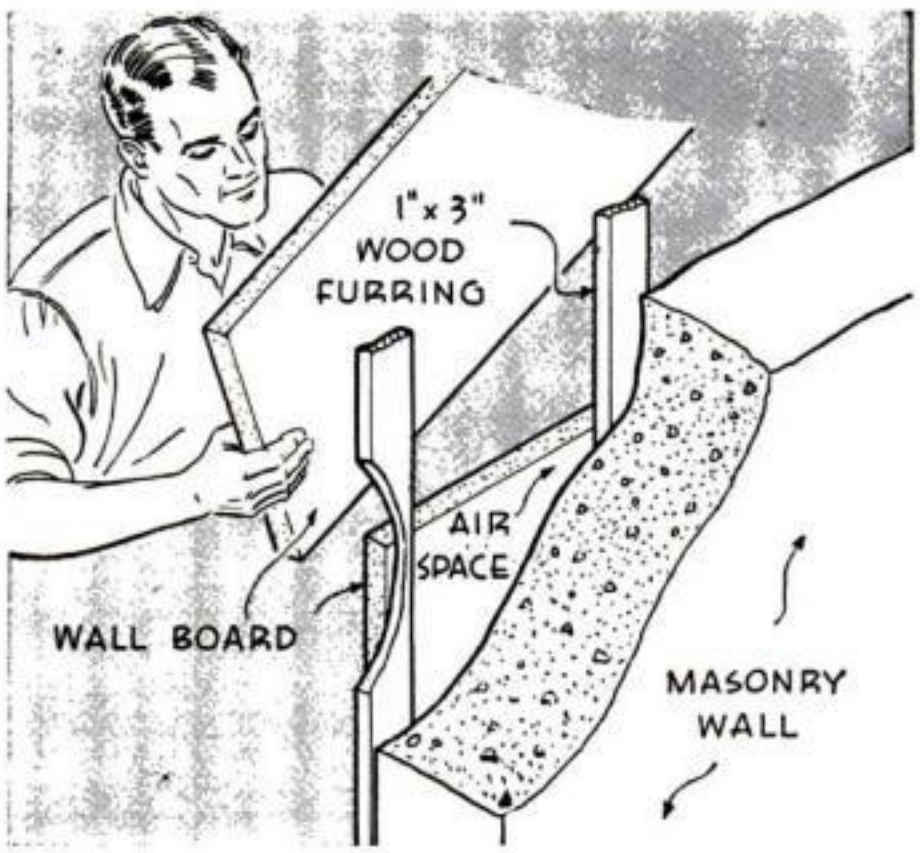
CEILING STRIP SET FLUSH WITH PANELING PERMITS BOARDS TO BE CUT TO UNIFORM LENGTH. MAKE STRIP LEVEL AND FIT TO CEILING. USE BASE STRIP TO MATCH. OMIT BASEBOARD

walls can likewise be repaired in this way.

If it is decided to re-cover a badly damaged wall with wood paneling, nail holes should not be filled with putty until after the stain is applied. The oil that exudes from the putty would prevent uniform staining of the wood by partially sealing the pores. Staining the edges of the panel boards before nailing them up will prevent the unsightly effect sometimes seen when joints open slightly, exposing unfinished wood.

Brick, stone, and concrete walls that transmit outside moisture into the building can be treated in several ways. First, any holes should be closed by pointing up the wall with Portland cement mortar. Porosity of the interior surface may then be overcome by troweling on a coat of waterproofed cement

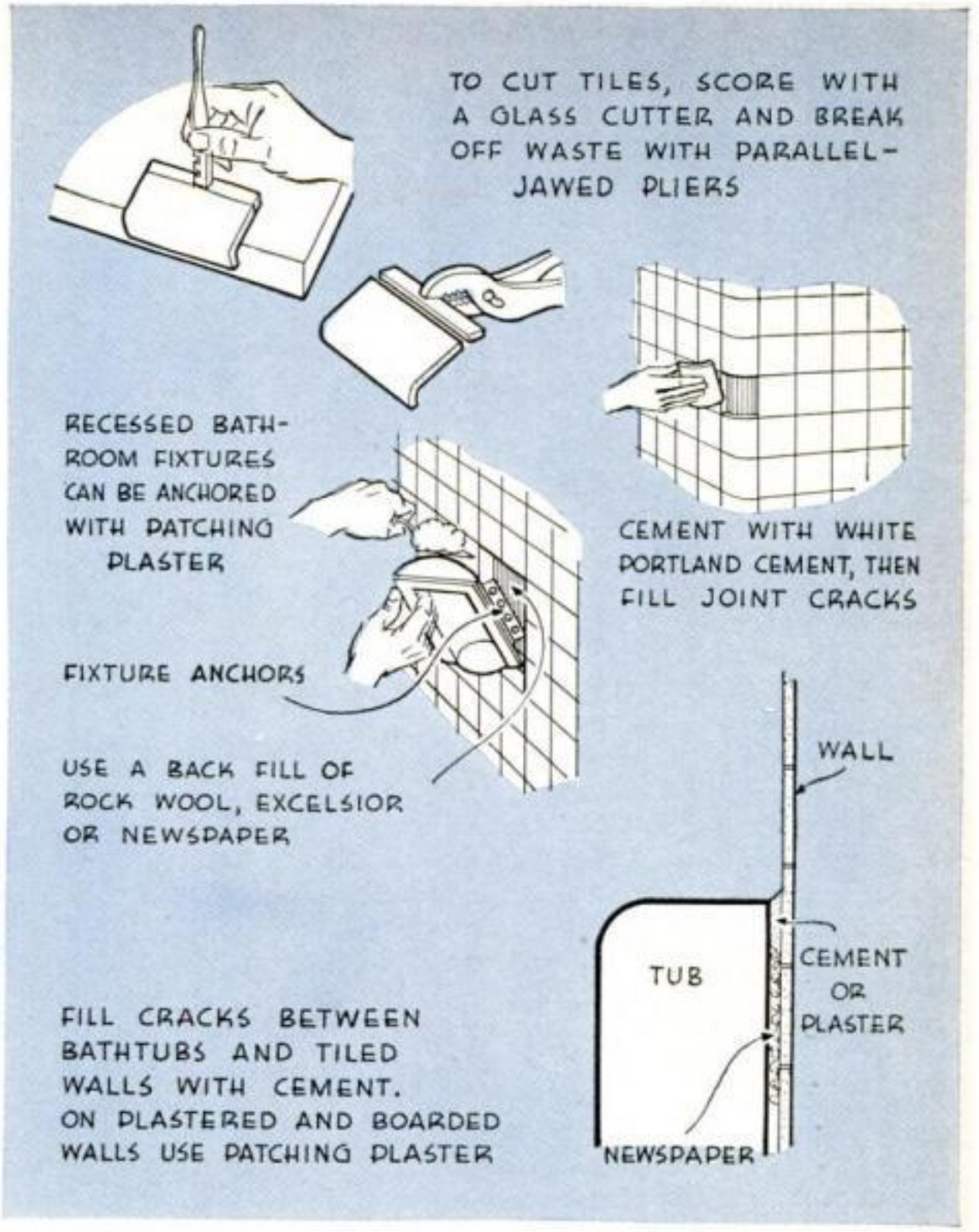
Masonry walls can be finished with waterproofed cement mortar or pitch. An excellent alternative method is to nail wall board to furring strips so that an air space is left between it and the masonry. Wall board coated to resist vapor penetration is ideal for the purpose



mortar or by swabbing on a coat of pitch.

The application of wall board, nailed on furring strips to create an air space between the masonry and the inside wall surface, is another solution to the problem. The use of wall board having a specially coated surface designed to stop vapor penetration would be even better for the purpose. Where plastering is to be done, a similarly treated plaster board can be used.

To replace broken tile on a bathroom wall, first soak the new tile in water to prevent its drawing the moisture out of the cement. If several rows of tile must be cemented in, uniform horizontal spacing may be maintained by laying pieces of string between the rows. Tiles on outside corners can be spaced by inserting match-stick wedges between them. These can be pulled out after the cement has partially set, and the spaces left should be filled with cement.



Soak new tile before cementing it. Space uniformly for neat appearance

DECORATORS' PASTE [*PAINTING*]

For patching decorative work and embossed designs, replacing lost parts of carvings and moldings, and similar purposes, a decorators' paste can be mixed as follows:

Rye meal or flour	2 lb.
Whiting	1 lb.
Casein glue	½ lb.
Powdered alum	¼ lb.

Screen together and mix dry, then use 2 lb. to 1 qt. of water. The paste can be applied with a putty knife, decorator's bulb, or pastry bag. It can be carved while still soft. This makes it useful for applying or patching gesso work, which is frequently required for gilded or polychrome decorations on picture frames and similar work.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Twin Closets for a Country Home

DESIGNED AND ILLUSTRATED BY JOSEPH ARONSON

SOME inscrutable fate has decreed that farmhouses, bungalows, and vacation homes in general must have insufficient closet space. The solution suggested in the accompanying sketches provides individual closets for "Mr." and "Mrs." in addition to a luxurious dressing table—and all at the expense of two feet taken from the length of the room, and, in a room of 12′ width, about $30 worth of material.

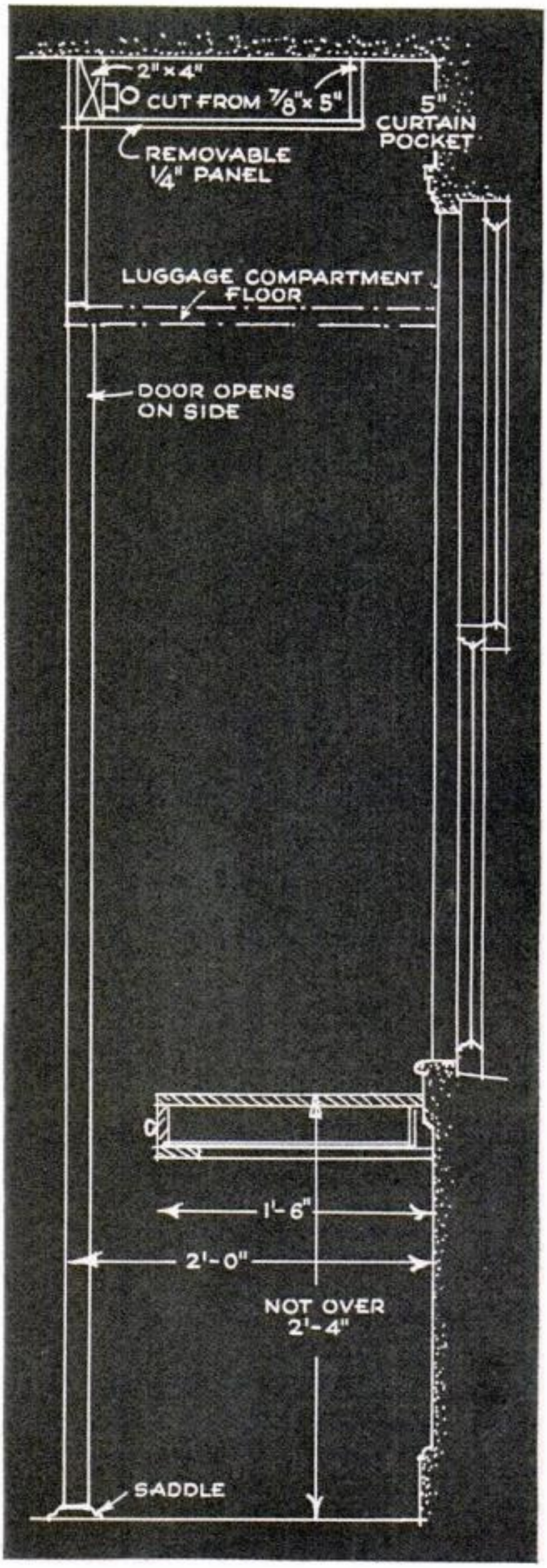
First, build the framework—a 2″ by 4″ nailed to the ceiling, with uprights of 2″ by 4″ or 2″ by 2″ as indicated. The sides should be of plywood, preferably ¾″ thick, and are set up at a slight angle to take full advantage of the light from the window.

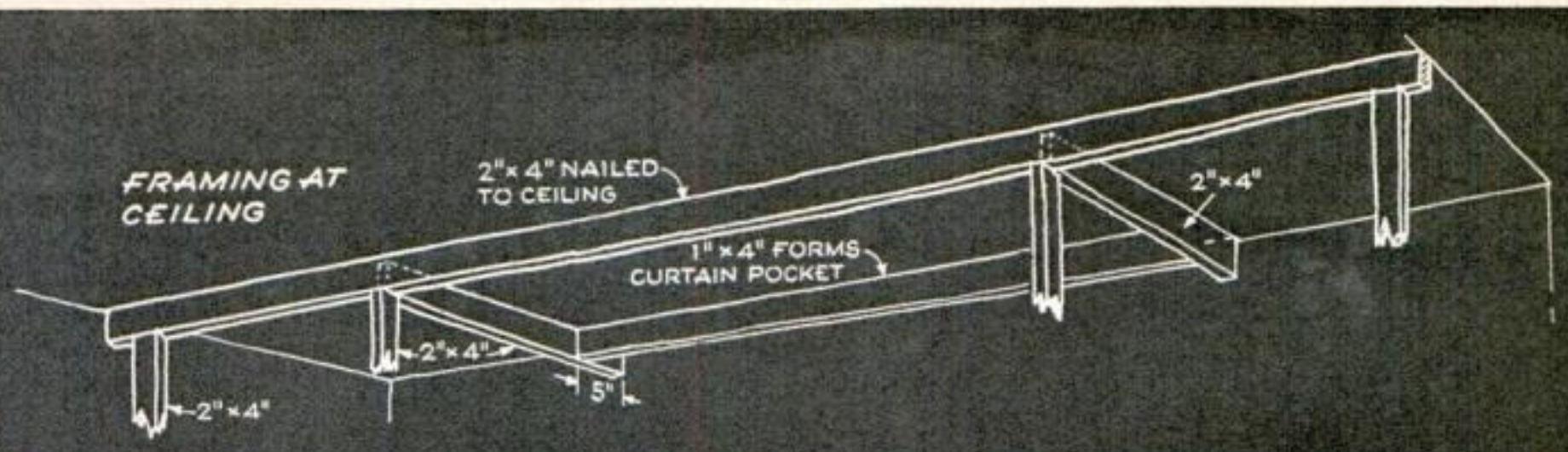
The doors overlap the entire side construction; the catches will therefore be of the friction or cupboard type. Over each large door is a small door to a compartment suitable for luggage.

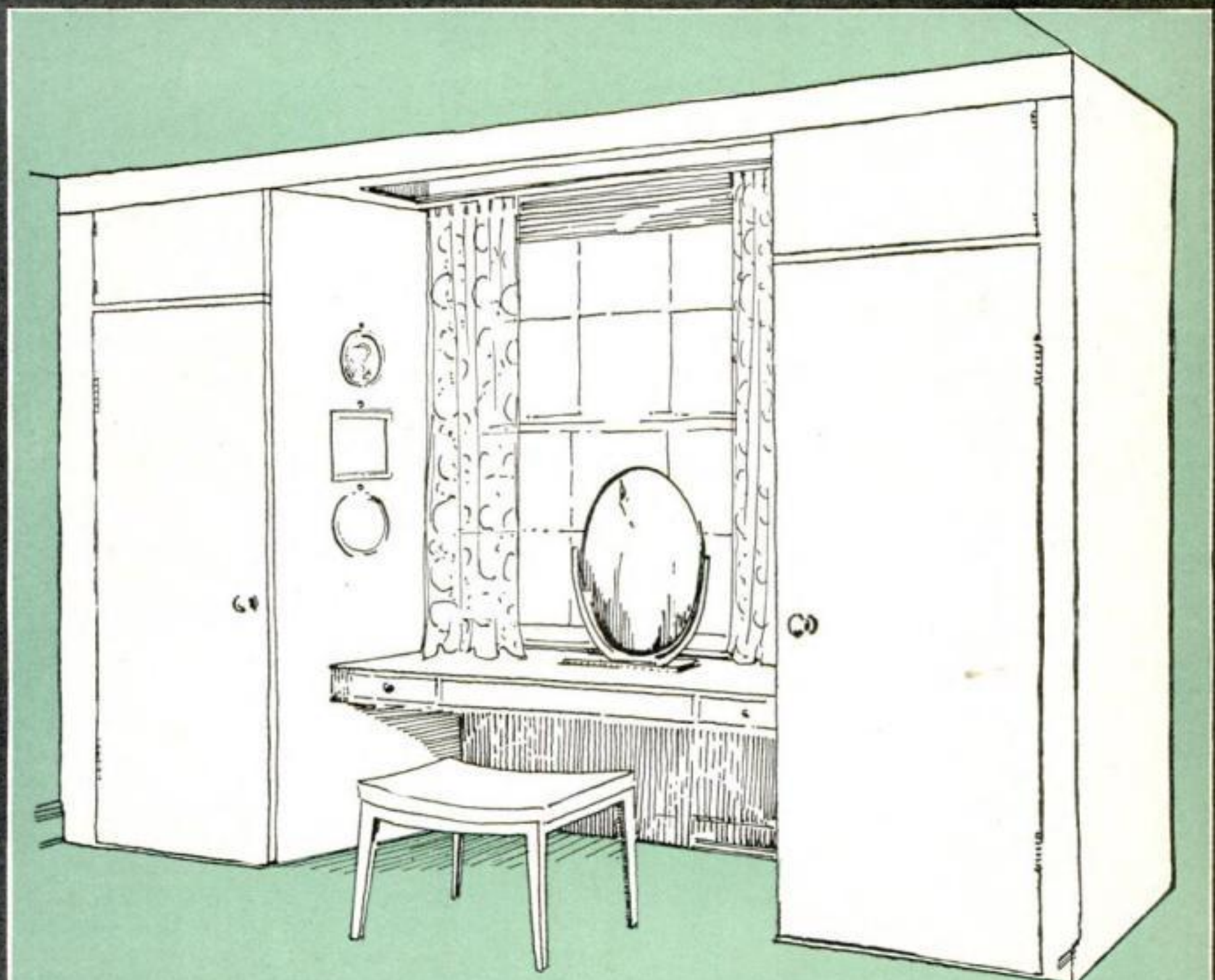
An optional ceiling arrangement for indirect lighting and a curtain pocket are also shown. Ordinary bulbs in porcelain sockets may be used. The ceiling panel is ¼″ plywood and extends the length of the dressing space, with a large oblong cut-out.

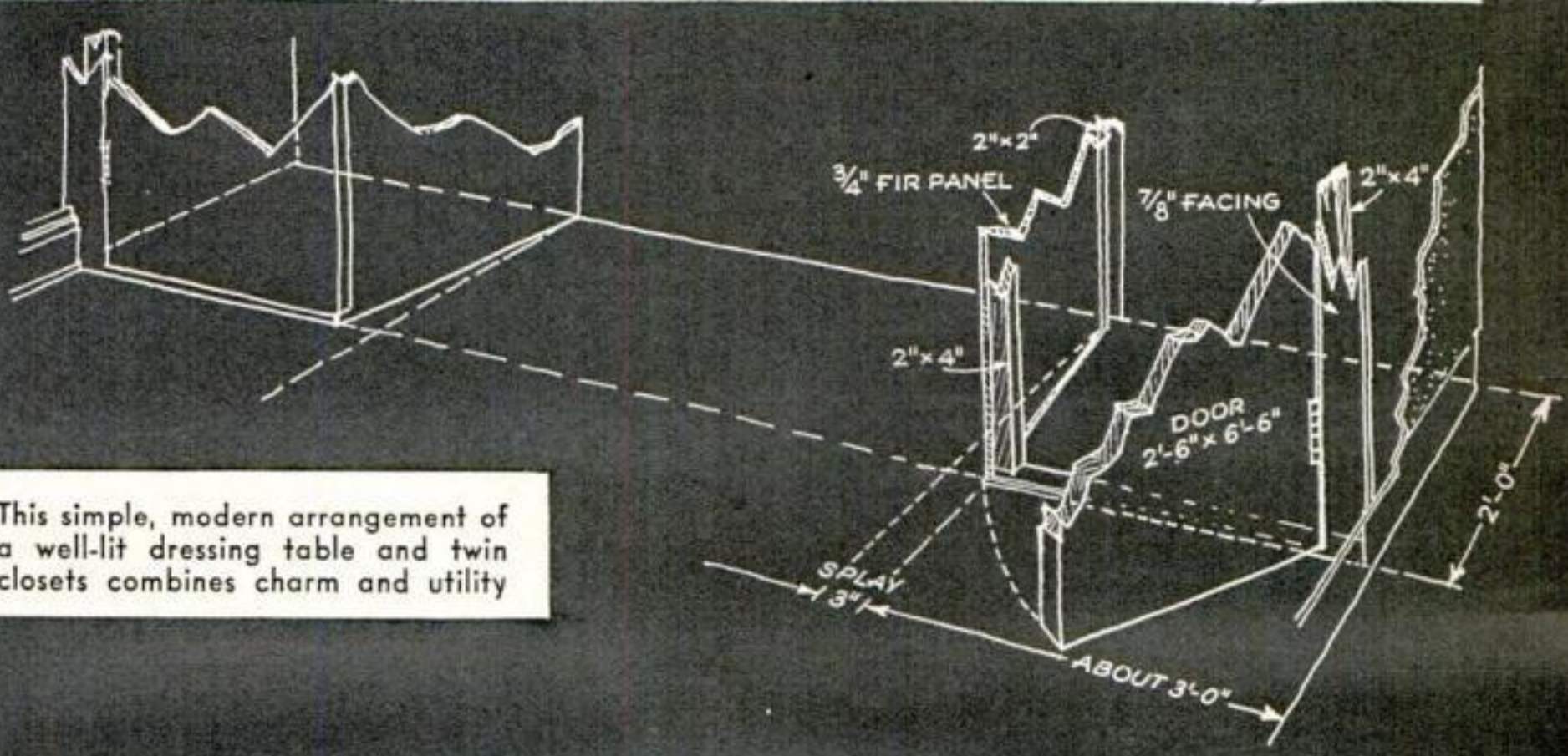
A style variation for an early Colonial house is shown in the small view below. Here board-and-batten doors are used. The boards run vertically in the large doors and in a pair of matched diagonals for the small doors. The valance over the dressing table is cut out of a pine plywood panel, recessed 2″ into the alcove space.

IN A COLONIAL HOUSE

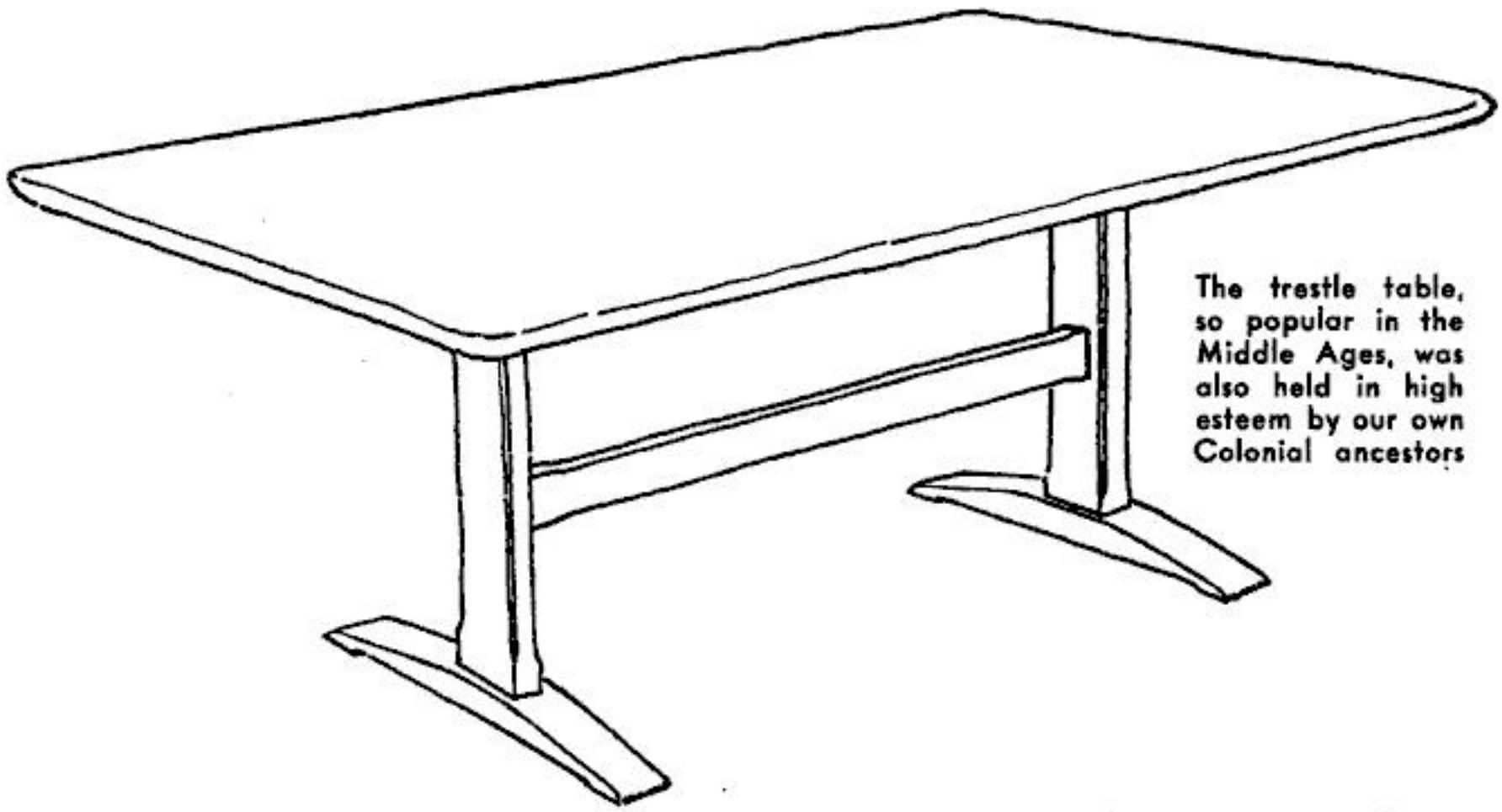








This simple, modern arrangement of a well-lit dressing table and twin closets combines charm and utility

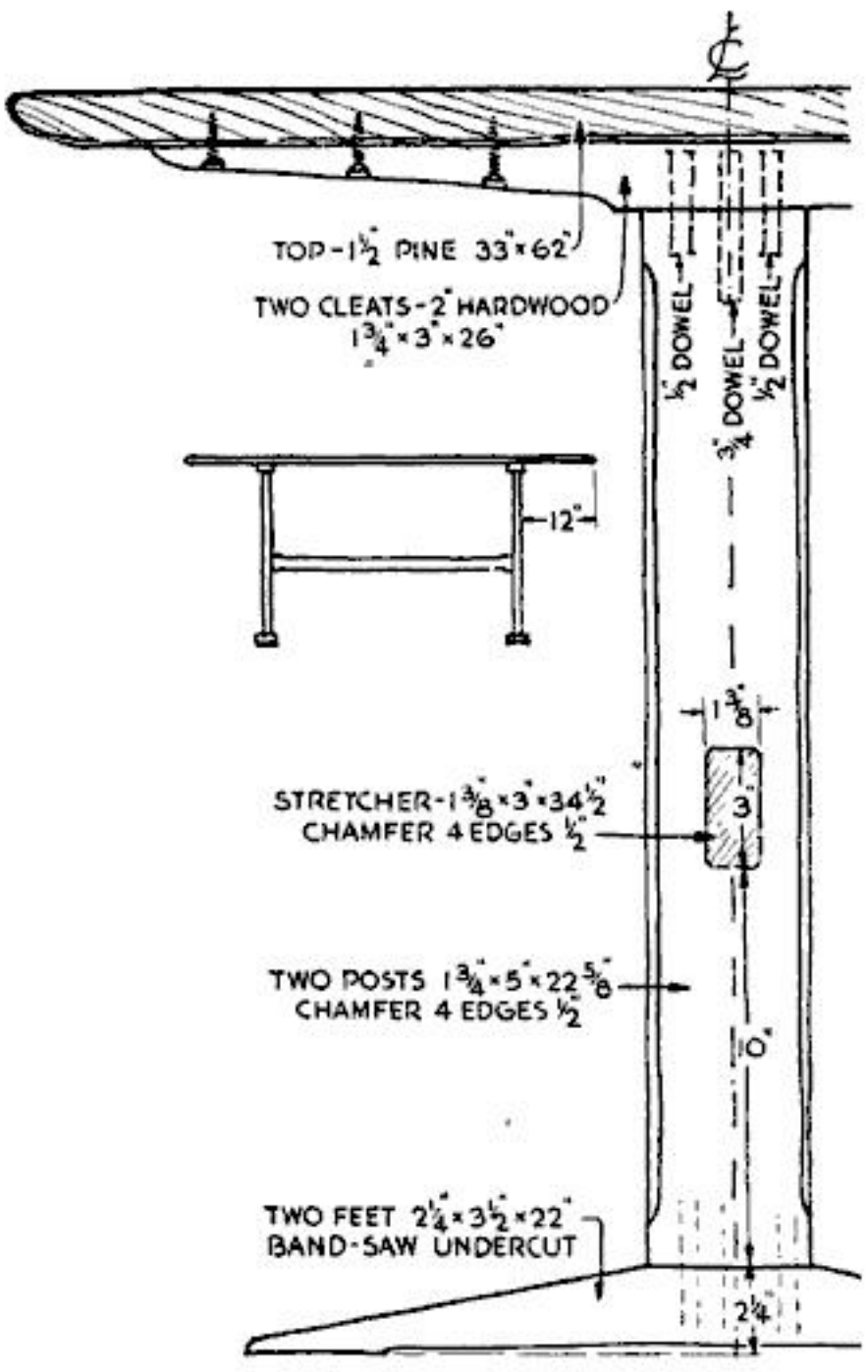


The trestle table, so popular in the Middle Ages, was also held in high esteem by our own Colonial ancestors

BY JOSEPH ARONSON

Author of *The Encyclopedia of Furniture*

Colonial Trestle Table



To preserve the fine proportions of the original, make the overhang approximately one fifth of the table length. Base parts are fastened with dowels, and the stretcher is similarly joined to the legs

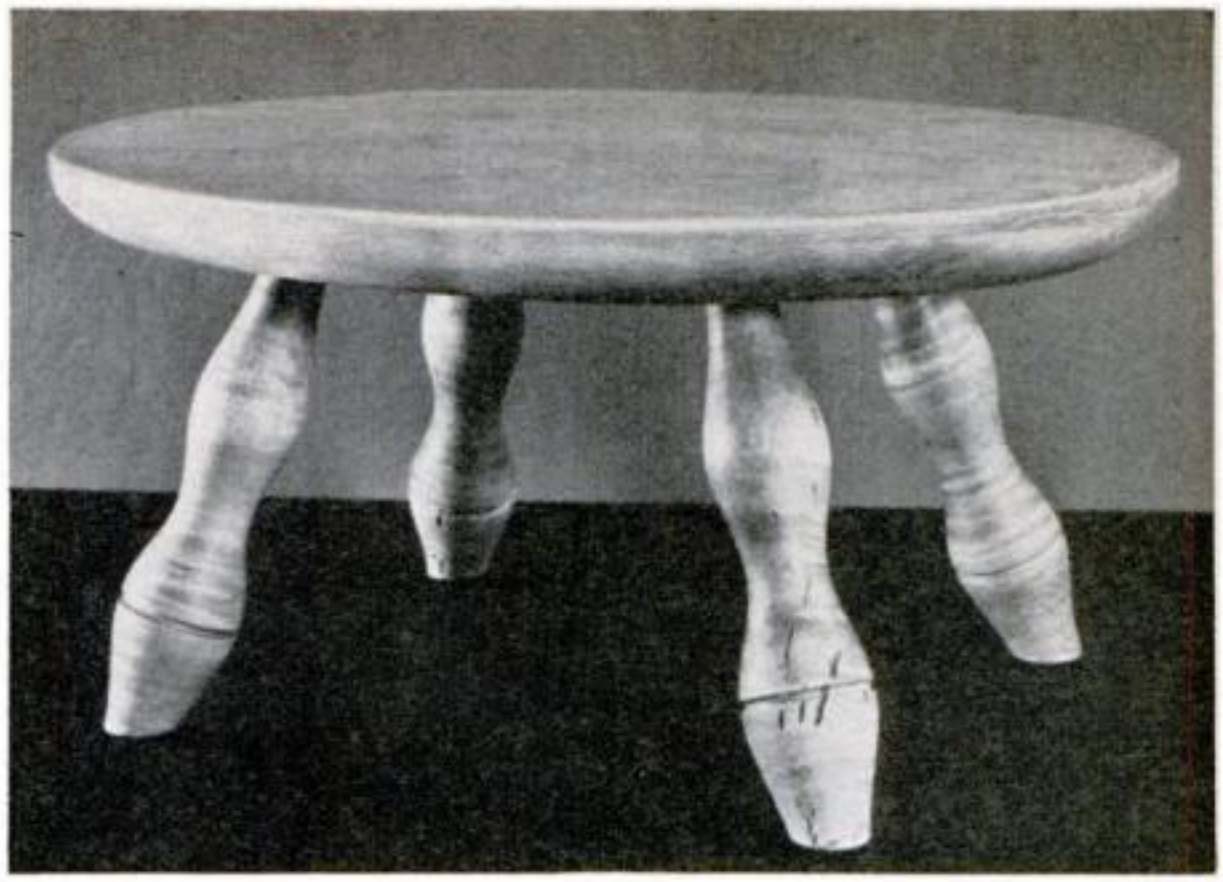
THE trestle table is one of the most ancient and practical table designs. This model is taken from a seventeenth-century Vermont antique. The original has a pine top, with oak, maple, and beech used at random in the base.

You can vary the size to suit your needs, but the proportions drawn, 33" by 62" by 28" high, are good for average use. The overhang at the ends—in this size 12"—should be reduced or increased proportionately to any changes in length. The solid pine top should be fastened to the base with roundhead screws, which pass through oversize holes (to allow for expansion and contraction). Use washers under the screws.

The original top was made of three boards, slightly beveled at the meeting edges. If a one-piece effect is preferred, it would be well to glue the top boards together with waterproof casein or resin glue.

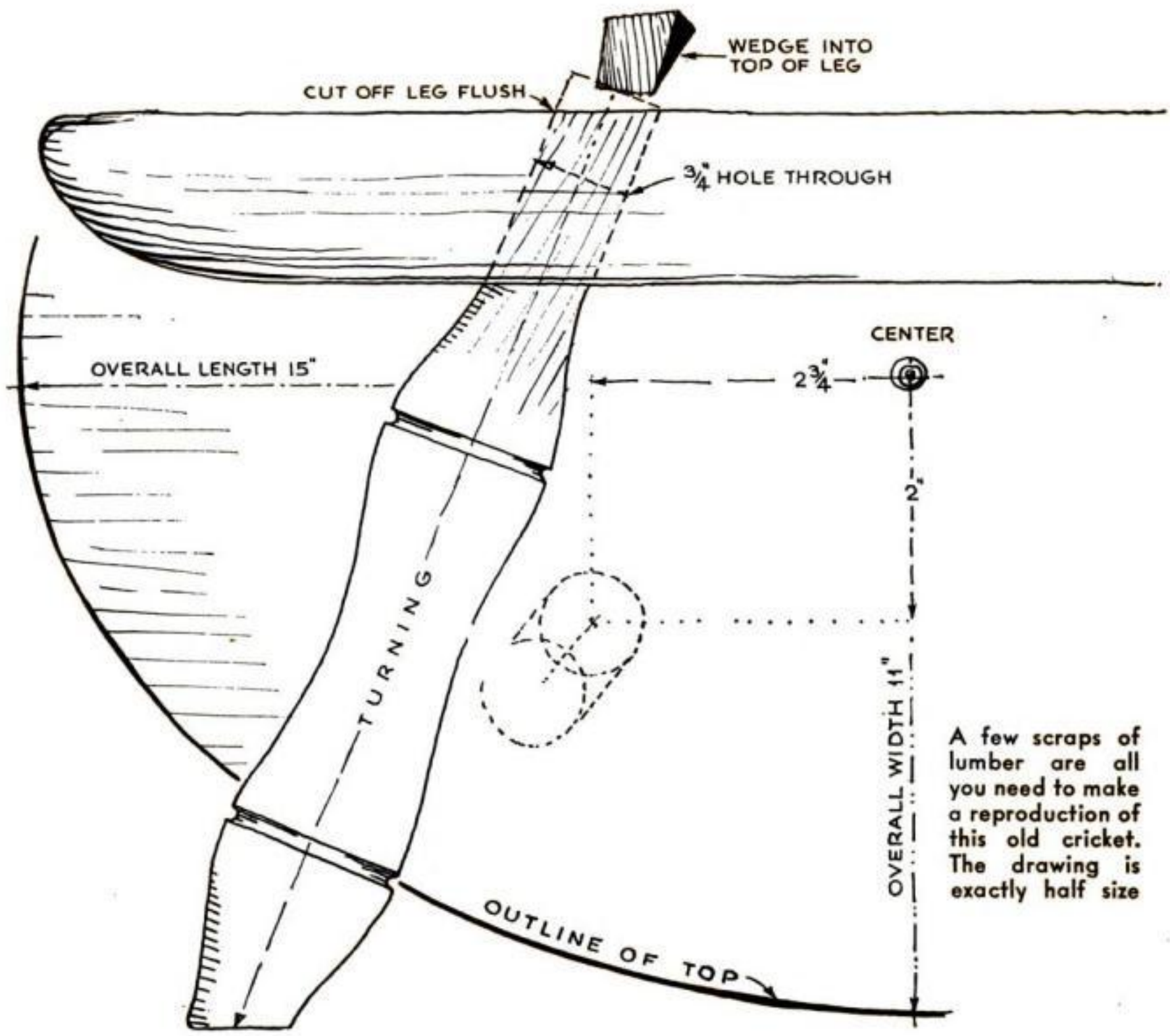
The best finish for this primitive American style leaves the wood in its most natural state; on the other hand, furniture in active use requires more protection. A fair compromise—if you are willing to administer frequent waxings—is this method: First sponge the wood lightly with warm water and wipe dry. Sand thoroughly with No. 000 garnet paper. Tone down to the desired depth of color with a stain of burnt umber in raw linseed oil. Two thin coats of white shellac should then be applied and sanded almost out with No. 5/0 garnet. Then at least three good coats of a hard automobile wax are rubbed in energetically. Repeat the waxing at frequent intervals.

Cricket Footstool

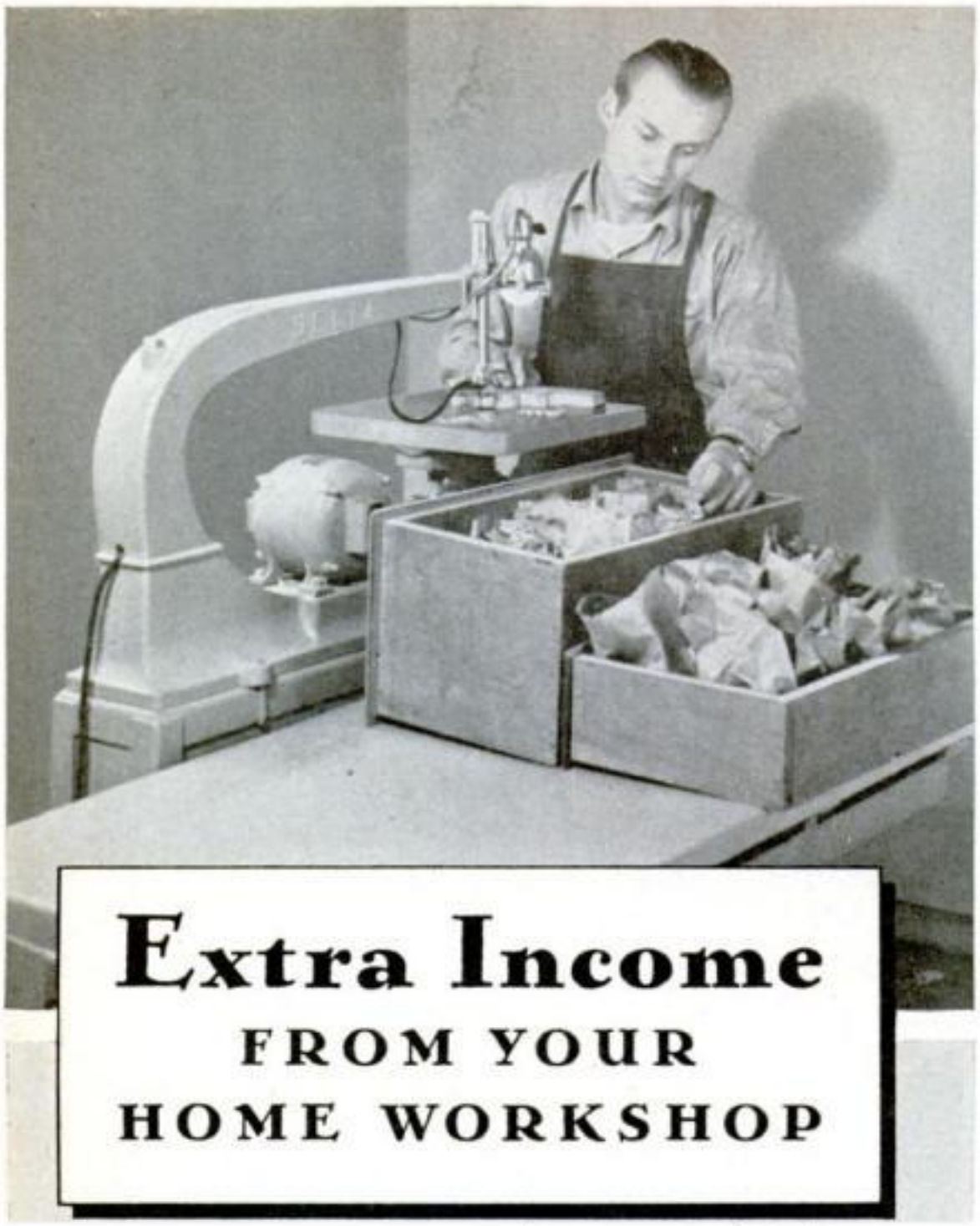


IN COLONIAL days no hearth was complete without a cricket for the comfort of the child who turned the roasting spit in the open fireplace. Nowadays these crickets are used as footstools.

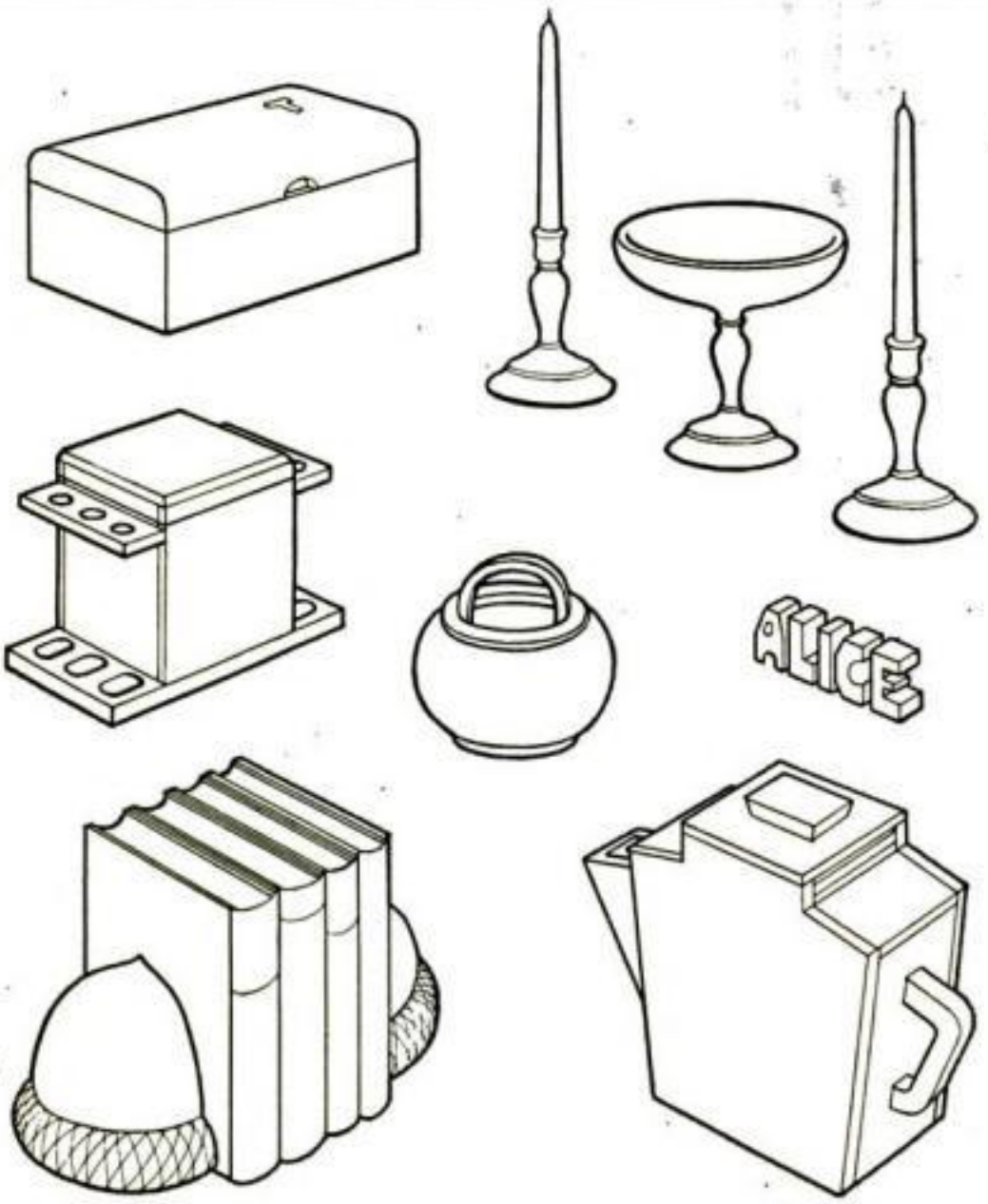
A thick pine board, about 1½" by 11" by 15", is cut to an elliptical pattern, and the edges planed and sandpapered to produce an irregularly worn effect. The legs are turned from maple, birch, oak, or other hardwood, and slots are sawed in the tenons to receive wedges. Bore ¾" holes through the top at the angle shown in plan and elevation, so that the legs flare out. It will pay to improvise a jig for this. Insert the legs, drive wedges into the slots, then cut off the protruding tenons flush with the top surface. Finish with several coats of penetrating wax of the desired color.



A few scraps of lumber are all you need to make a reproduction of this old cricket. The drawing is exactly half size



Extra Income
FROM YOUR HOME WORKSHOP



By EDWIN M. LOVE

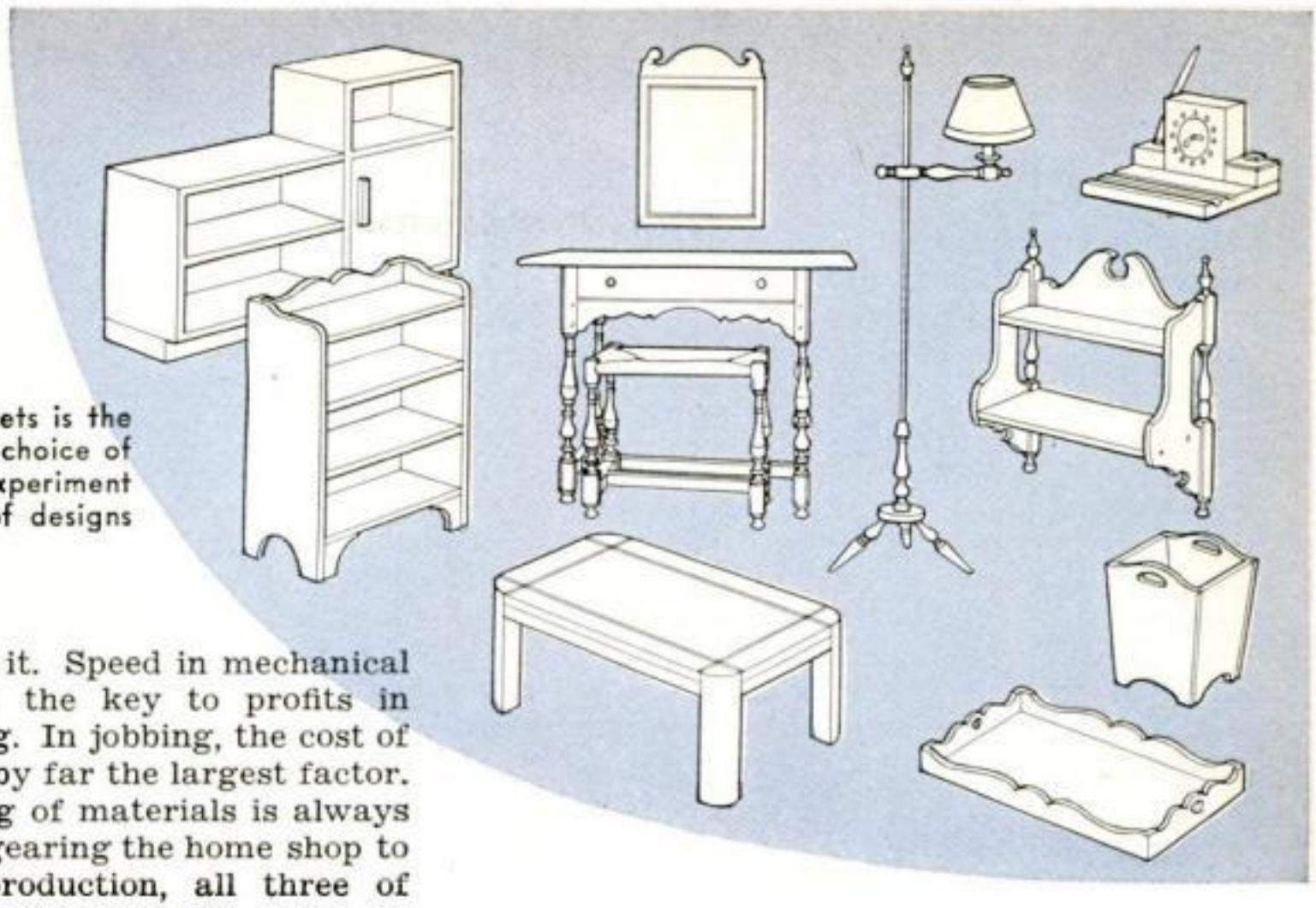
CAN the home workshop be a source of income? The answer is that it can. Thousands of one-man shops throughout the country afford full or part-time employment for their owners. Many have grown into two-, three-, and four-man shops, and even into small factories.

The amateur craftsman who has other regular employment and therefore has no desire to make a business of his hobby may, nevertheless, welcome extra money with which to purchase better tools, pay for materials for some pet project, or buy other articles not provided for in the family budget. There is besides a real satisfaction in creating a demand for one's individual products, and in turning out work for which others are glad to pay.

The problem of turning your skill to profit should be approached with ordinary common sense. It is wise to discard at the outset the idea of making a fortune overnight, or of gaining an "easy" job at home, and to face the fact that success will require hard work and intelligent enterprise, which can, however, be a source of keen satisfaction to the man building his own business.

Make a careful survey of your assets and liabilities. An honest appraisal of these will save you time and money. Study your skills, tastes, and inclinations. Will you be able to make the necessary personal contacts to sell your wares, or must this be left to some one else? Is your shop equipment adequate? Are there potential markets near by? Can you obtain a permit, if necessary, to operate in your present location?

Whatever field you propose to enter, you will find fairly definite prices already



A study of markets is the best guide to a choice of what to make. Experiment with a variety of designs

established in it. Speed in mechanical duplication is the key to profits in manufacturing. In jobbing, the cost of hand labor is by far the largest factor. Shrewd buying of materials is always essential. In gearing the home shop to commercial production, all three of these considerations enter.

Jobbing offers perhaps the safest start in the commercial field. Making built-in kitchen cabinets, linen closets, bookshelves, porch seats, trellises, and the like, lining closets with cedar, modernizing fireplaces—all come under this classification, and must usually be done on contract, at prices that will meet local competition. As lumber costs are readily estimated, the risk in bidding, even for the beginner, is not formidable. Even if the estimate proves to be too low, no direct money loss should result. To show a fair return for time spent, you must, of course, turn out creditable work as quickly as the average professional. Portable woodworking machines that can be set up on the job or permanently installed on a trailer will go far toward helping you to meet competition.

Similar to jobbing is cabinetmaking—the building of new furniture and repairing and refinishing of old. Like other fields it has its drawbacks. Some customers may expect to buy especially designed and constructed pieces at the same price or less than stock factory models can be purchased for, but this is impossible. Handmade furniture cannot compete in price with that turned out on automatic lathes and with production machinery. However, some localities will afford a market for custom-made pieces at good prices.

Art products, gift wares, and the like are marketable in proportion to their novelty and quality. Few home shops can compete in the manufacture of ten-cent-store merchandise, but a cleverly designed article in a higher price range will often yield steady profits, for the public is eager to buy pieces that are truly out of the ordinary. Medium-priced products might be sold in moderate quantities, whereas high-priced or exclusive designs, if your community affords a market for such, might show a good profit even though requiring considerable time to make.

In this field good crafts-

8 Pointers for Making Money

1. Make an honest estimate of your skills, equipment, potential markets, and ability to get along with customers.
2. Start modestly, on a part-time basis. Do not invest your full time or much money until you have gained experience.
3. Keep trying until you succeed or are sure you are on the wrong track. Many businesses fail when close to success.
4. Try local markets first. If your products will not sell there, they probably will not sell elsewhere.
5. Diversify by making several items rather than only a single one, unless you control a patented product.
6. Study materials and their costs. Save by careful shopping, using scraps, and buying with other craftsmen in quantity.
7. Read books and magazines to familiarize yourself with production methods, new processes, and timesaving short cuts.
8. Keep a set of books showing income and expenditures.

manship and designing ability are essential. Display your work to as many friends as possible, urging them to criticize freely. Redesign with their comments in mind. Be cautious in accepting mere praise; there is little to be learned from it.

Ideas for craftwork abound in shop windows, in advertisements, in books and magazines. You have no right to make out-and-out copies of commercial products, many of which are patented or protected by design patents, but designs of the type published on the craftwork and woodworking pages of this magazine are yours to use without question. In any case, however, it is desirable to select or develop an individual style of design by which your products may be identified. Many projects published in this department from month to month, for example, may be used without substantial change by adapting the basic design to your individual style.

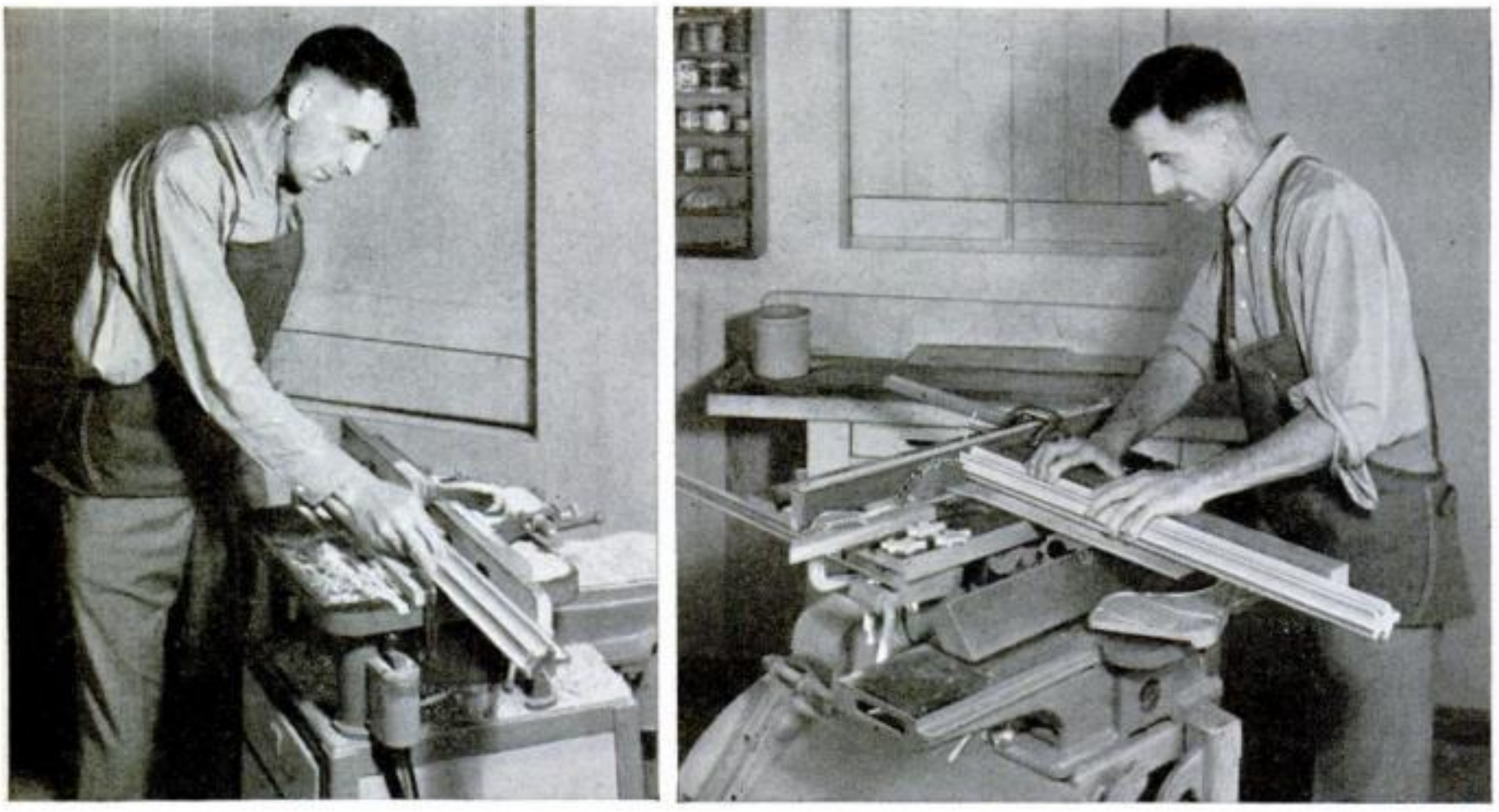
Simplification of an article is often necessary to make profit possible. Strive to reduce the number of parts and the number of necessary operations. Study the possibilities inherent in different materials. A piece commonplace when made of wood may be distinctive if made of plastic, and although the latter material is expensive, it eliminates the expense of painting. Designs in plastic may be equally attractive if made in wood or metal, and possibly more suited to home-workshop production.

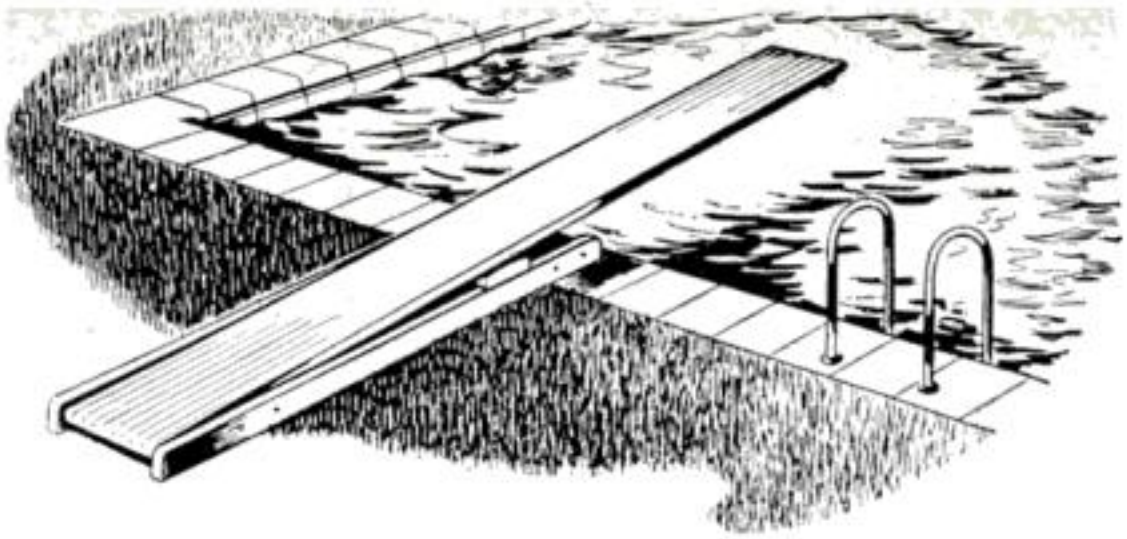
To make small, moderately priced articles in quantity, a knowledge of duplicating methods is essential. Script name pins, for example, can be cut five at a time from ⅛" plywood, the sheets being held together by brads in the waste portions. Box jigs can also be used, both for sawing and drilling operations. Still another method is shown in two of the accompanying photographs. A length of stock is shaped to the desired profile, and thin sections cut off with a dado or crosscut blade on the circular saw. Study every such method you can find, with a view to applying it to your own production problems. The one just described, for example, is especially applicable to making place-card or price-tag holders, seasonal items such as Easter bunnies and chicks, animals for toy Noah's arks, and similar articles of simple design.

Whatever the products or services you have to offer, they must be brought to the attention of your prospective customers and kept before them. One way to begin, involving no risk, is to take orders from door to door, and make up only what you have sold. Shops will often sell goods on consignment, and it is only fair, if you offer your wares through dealers, not to sell directly to customers in the same territory. Friends and neighbors may be willing to help with word-of-mouth advertising, or you may find it profitable to send out circulars and post cards, or to advertise in local newspapers. If you live beside a well-traveled highway, an attractive sign stating what you have to offer may soon bring you more business than you are able to handle.

Just as the buyer usually gets exactly what he pays for, so the producer will, in the long run, obtain only the amount of business his goods merit. Permanent success is possible only by building a reputation for excellent work and fair dealing.

Profiles of simple items can be formed on a shaper, and pieces cut two at a time with a dado head





LAMINATED DIVING BOARD

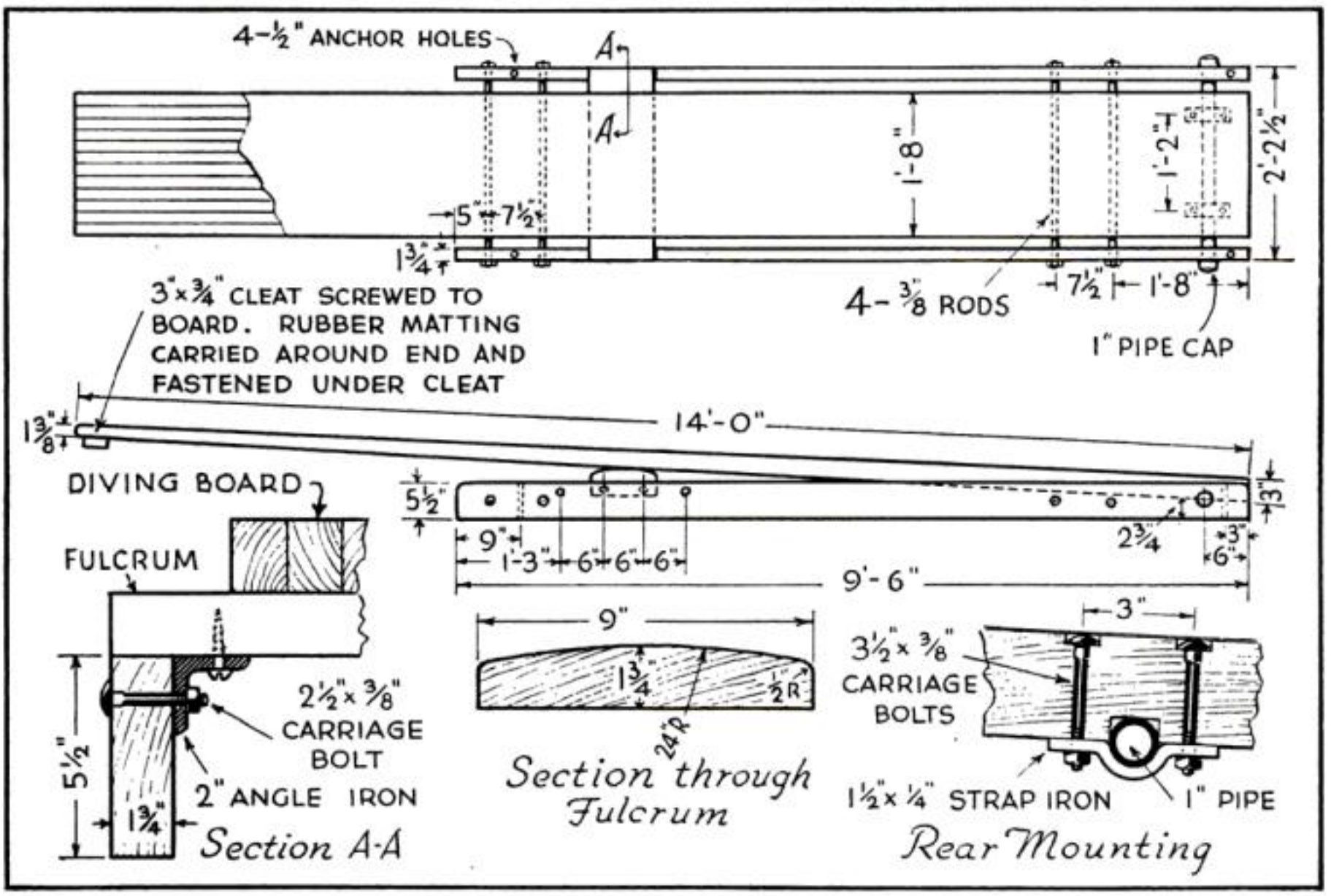
A GOOD diving board is an asset to any summer camp or swimming pool, but a suitable plank is apt to be expensive. The Forest Products Laboratory of the United States Forest Service at Madison, Wisc., has developed a comparatively inexpensive type of laminated board, which, in actual use at a public beach, has outlasted ordinary boards five to one.

The experimental boards were made of southern yellow pine. Small knots are permissible if not within 24" of the fulcrum. The laminations are 2" wide, tapering in thickness from 3" at one end to 1⅜" at the other. They can be cut most economically by ripping 2" by 6" planks.

Cold-setting casein or resin glue must be used, with plenty of clamps to hold the laminations together and keep top and bottom surfaces in line. Use glue only; do not attempt to bolt the laminations together.

To protect the glued joints, the top, edges, and ends of the board must be covered with rubber matting. A low grade is preferable because the rubber contains more fiber and tar and can therefore be glued more securely to the wood with casein or resin glue. Coco matting should be fastened over the rubber to afford a nonslip footing.

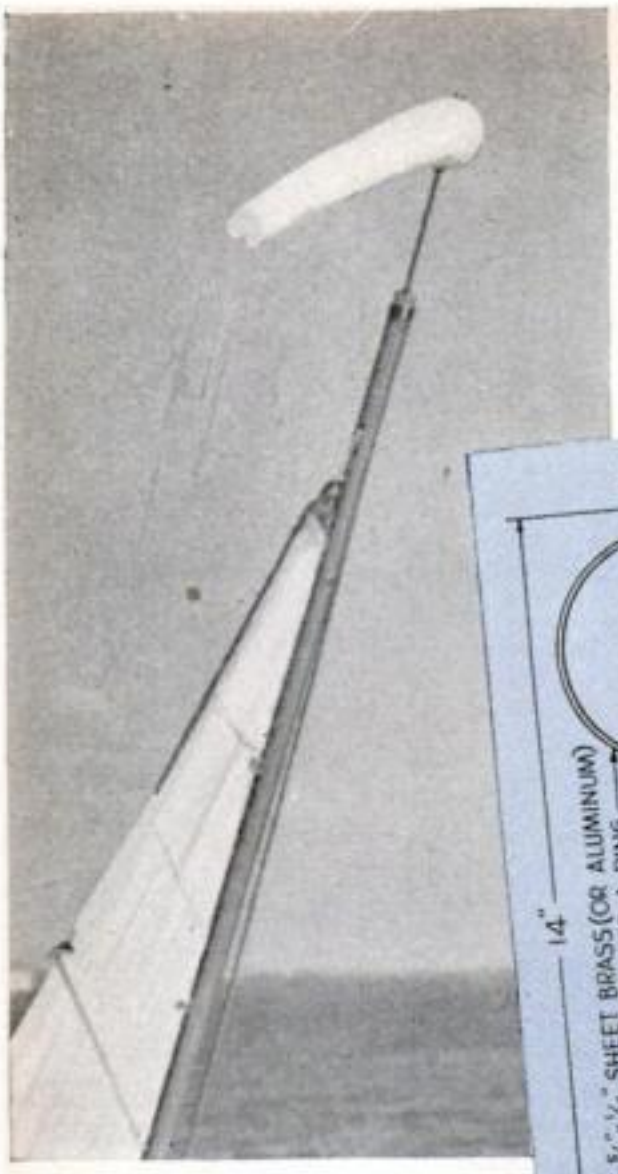
The use of a pipe as a fulcrum should be avoided, for it concentrates shock loads over too small an area of wood fiber and leads to early failure of the board. Use the broad, slightly rounded wooden fulcrum shown.



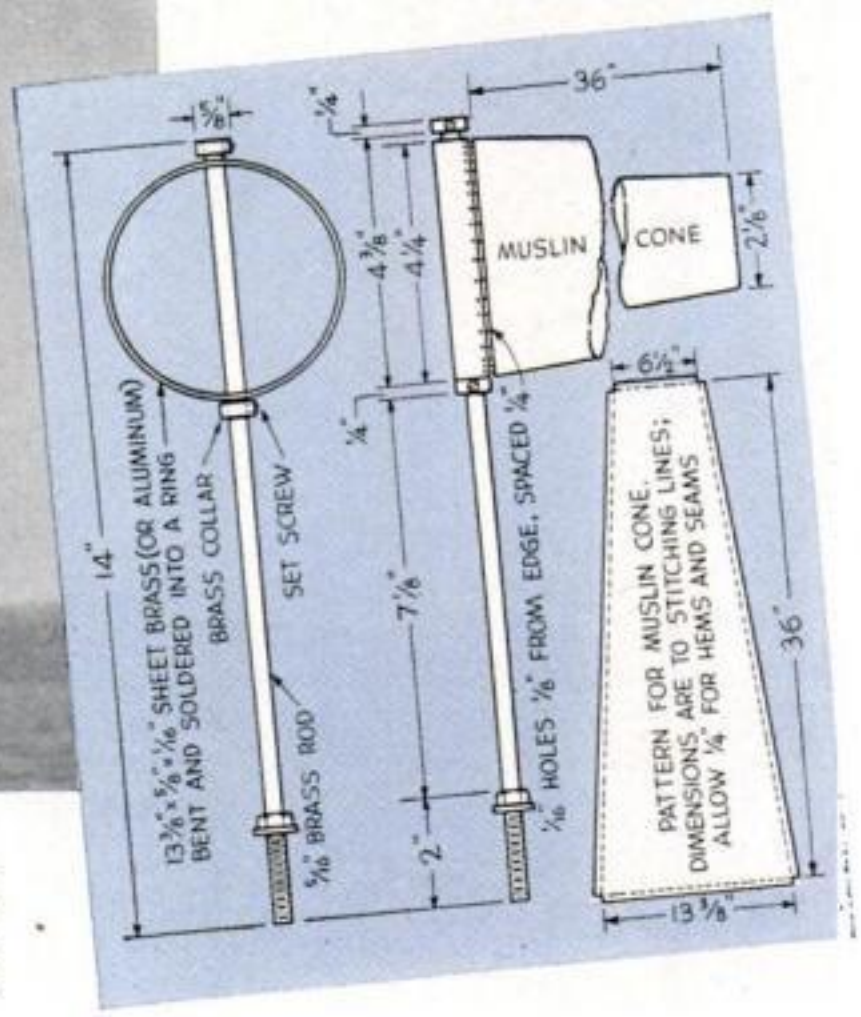
Properly made and covered, this board should give years of service. The wooden fulcrum is adjustable

Miniature Wind Sock at Masthead Aids in Handling Sailboat Effectively

AUTHORITIES agree that no sailboat can be handled to best advantage unless it is fitted with some sort of wind vane or pennant. The wind sock illustrated is patterned after those used at aviation fields and serves admirably on a boat. It can be made of muslin or similar material, hemmed at the ends and stitched up the side. The tip must be left open, or the sock will not fill properly.



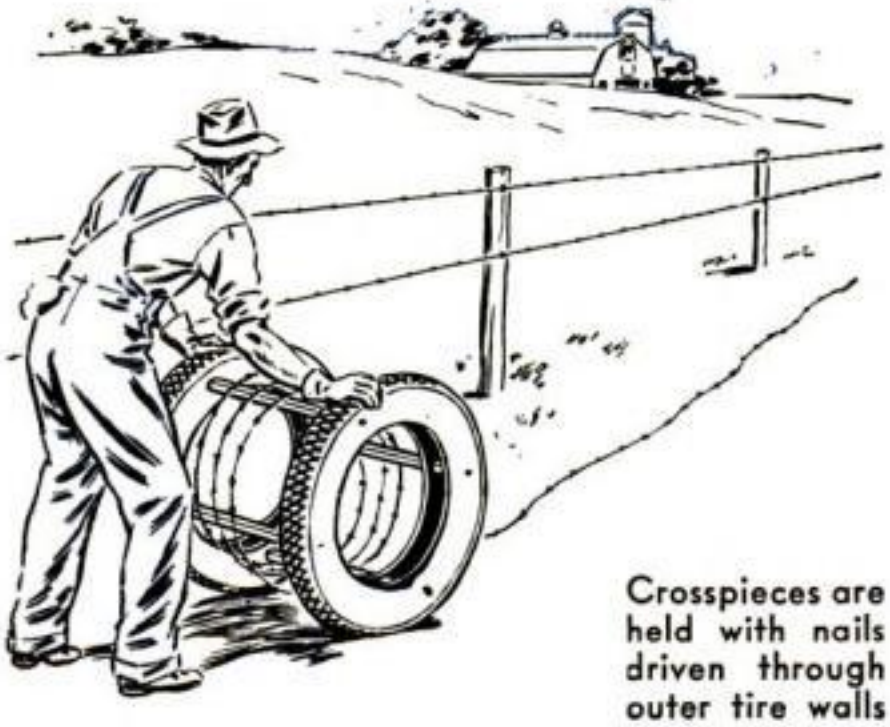
By indicating wind direction, this cone pennant helps to get top performance from any sailboat



To mount the device, a ¼" hole is bored 2" deep axially into the mast tip, which should be protected from splitting by a tight-fitting collar or a wrapping of heavy copper wire. Run a nut up the threaded portion of the 5/16" staff. This will serve as a stop collar. Slip on a washer also. Then screw the staff into the ¼" hole in the mast.—W. MACK ANGAS.

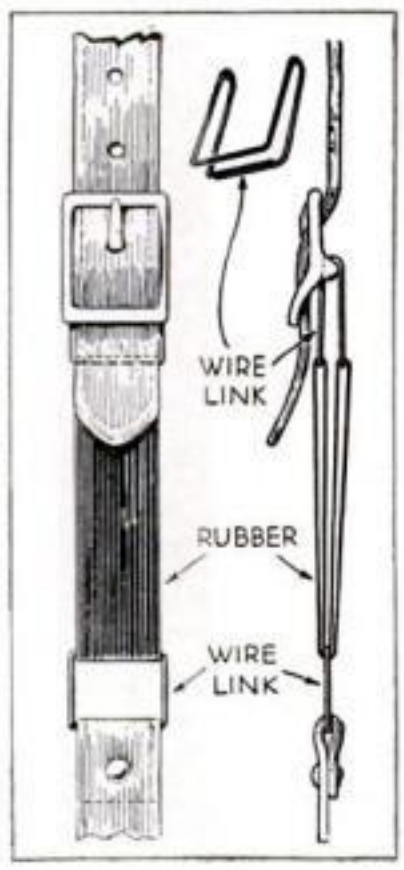
Old Auto Tires Used as Reel for Taking up Barbed Wire

THIS BIG reel makes it easy to take up barbed wire from temporary fences. Two old auto tires and four sticks about 1" by 1½" by 25" are needed. Cut holes for the sticks in one wall of each tire, assemble with these walls facing each other, and secure the sticks by driving nails into them through both outer tire walls.—A. R. MCFADDIN.



Crosspieces are held with nails driven through outer tire walls

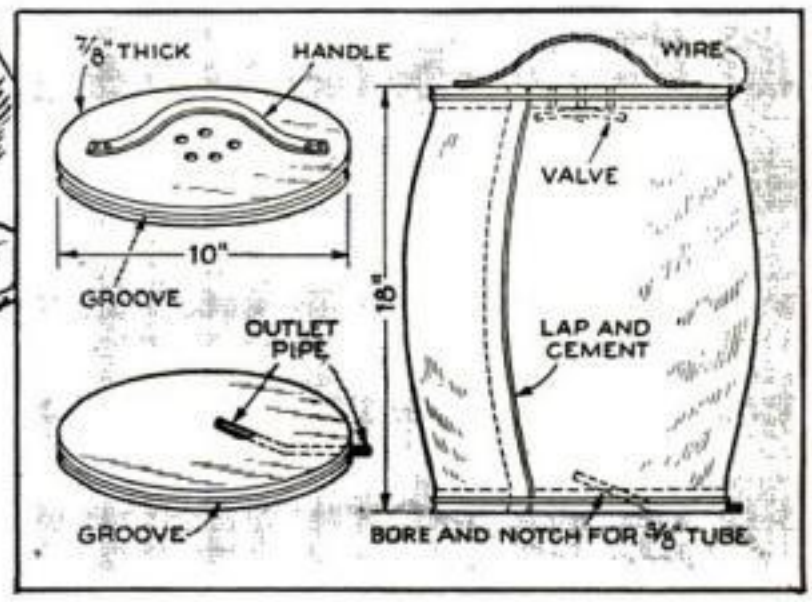
The links must be bent from stiff wire. Several can be made from a single wire coat hanger



Rubber Insert Keeps Strap Taut

ARTICLES strapped to the package rest of a bicycle are less likely to jar loose if a heavy rubber band, cut from an old inner tube, is inserted in the strap by means of two wire links as above. Such a strap is also useful for clamping glued parts of irregular shape.—BERTRAM BROWNOLD.

Wire clinches the rubber into grooves around top and bottom. The intake valve is a rubber flap held by a single screw



Simple Bellows Pumps Up Pneumatic Camp Beds Quickly

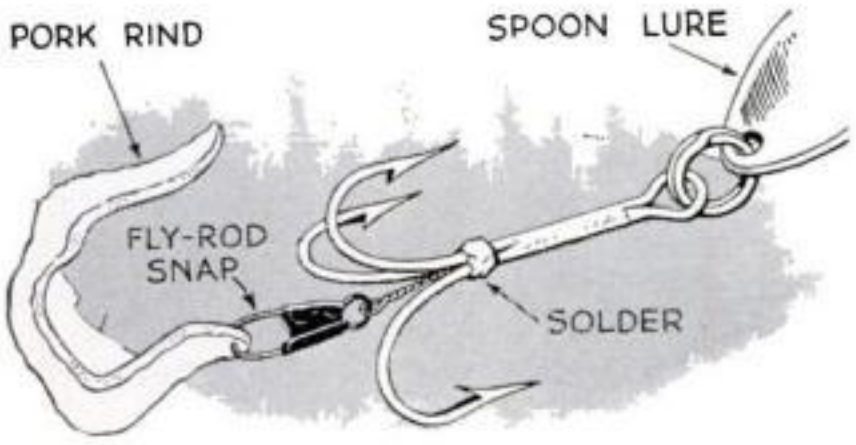
FILLING several air beds with a tire pump took so much time and hard work that I made the bellows illustrated from two wooden disks and rubber from an old inner tube, which was split along the inside and cut to lap over about an inch. To operate, the top disk is pulled up and pushed down slowly. About ten strokes will fill a bed, whereas it takes 200 or more strokes of a tire pump to do so.—F. R. SANBORN.

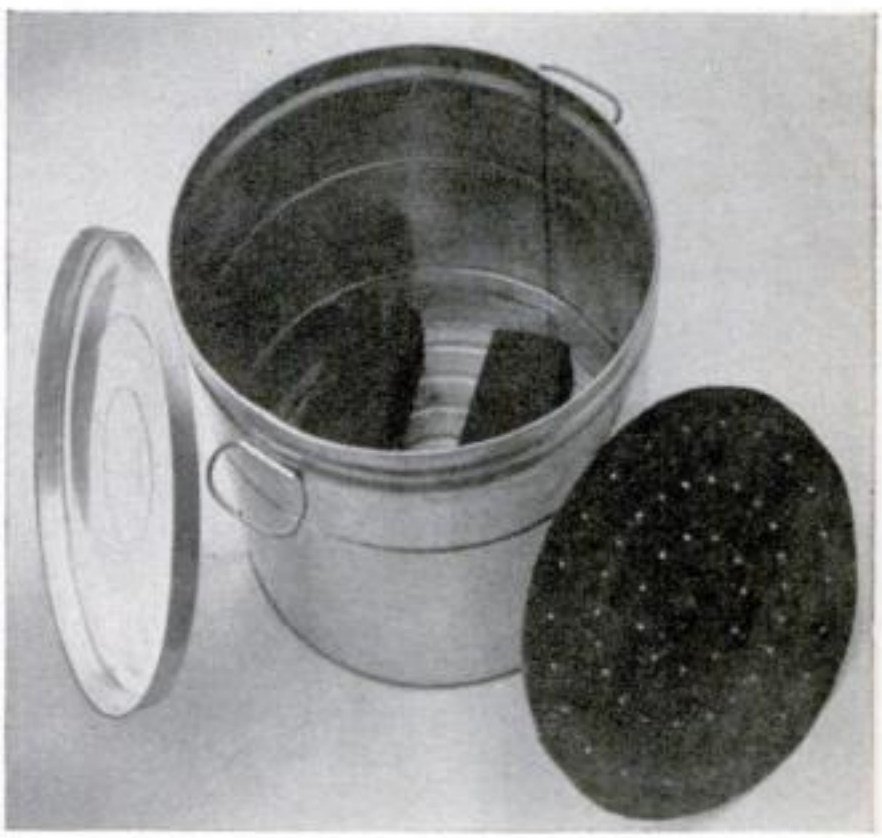
Taping Leaks in Garden Hose

TO TAPE a leak in a garden hose, first apply electrician's rubber tape, stretching it well. Cover this with a layer or more of black friction tape. Should the friction tape loosen, it can be replaced without disturbing the original repair.—W. H. QUADE.

Fastening a Pork-Rind Strip to a Plug or Spoon Lure

FISHERMEN often add attractiveness to a plug or spoon lure by attaching to it a strip of commercially bottled pork rind. To center this so the plug or spoon will weave through the water in a natural way, wire in and solder a small fly-rod snap to the gang hook. The rind can then be attached by the snap.—ROBERT PAGE LINCOLN.





Lard-Can Sterilizer Improves Soil for Use in Seed Flats

STEAM-STERILIZING the soil used in seedling flats eliminates weeding and trouble from damping-off fungi. Cut a heavy tin disk to fit closely inside a 5-gal. lard or paint can with a cover. Punch nail holes in the disk as shown above. Put two bricks on edge in the can, pour in about 3" of water, and drop in the disk. Fill to the top with soil. Cover loosely. Boil for thirty minutes after steaming begins.—S. Y. CALDWELL.

The rigging is simple and inexpensive, and the sails may be quickly and easily removed between trips

Cruising Sailboat

PART V: HOW TO COMPLETE OUR NINETEEN-FOOTER

By Bruce and Willard Crandall

IF AN inboard motor is to be used in our new 19′ cabin sloop, it will be best to make a full-sized drawing of the profile view showing the skeg, keel, keelson, engine beds, and location of the frames. From this drawing can be determined the exact angle of the shaft, and the angle and height of the engine beds.

To avoid all danger of boring the shaft hole incorrectly, the skeg can be made of two 1⅛″ pieces. Half of the hole for the shaft is then cut out of each piece. These two pieces are fastened together with bolts and screws after the joining surfaces have been coated with marine glue. Once the skeg is in place, the hole can be continued by boring through the keel, keelson, and shaft log, using the hole in the skeg as a guide for the bit. The shaft log should be made water-tight where it joins the keelson by the generous use of marine glue and a canvas gasket.

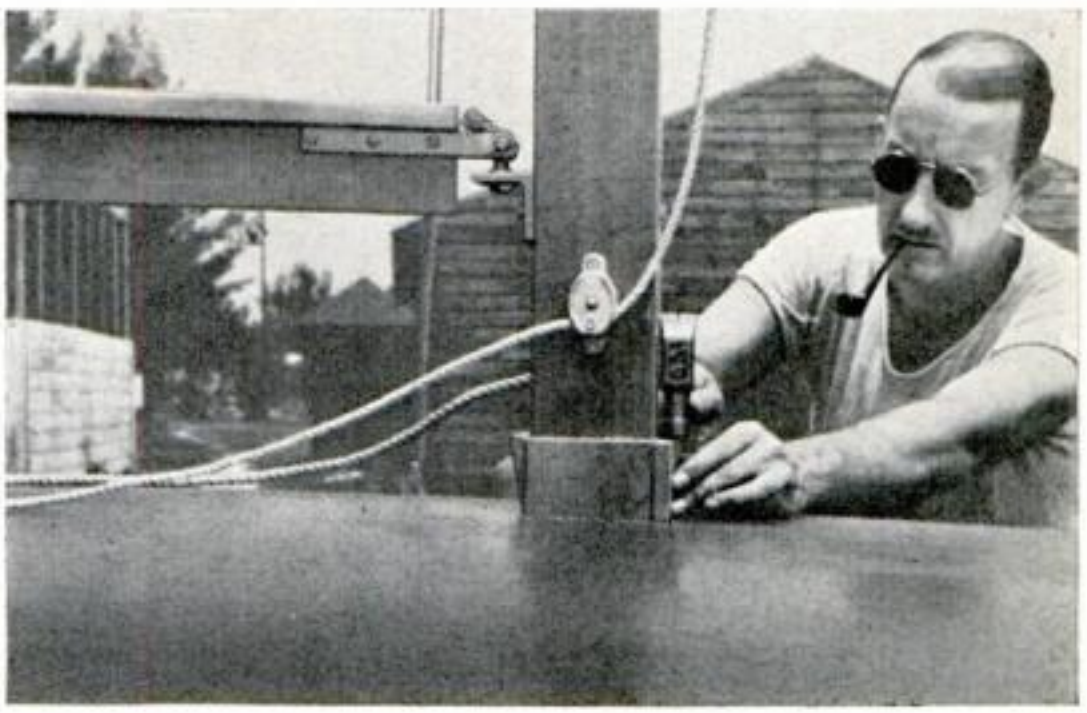
The entire outside of the hull should be well sanded before being painted. The water line may be marked by placing the boat in correct position on a level floor and then marking all around the hull an even distance up from the floor. Alternatively, the approximate location of the water line may be marked at each station on the planking by referring to the table of offsets, and then the line trued up with a long batten. Re-

member, however, that the water line is 10" above the base line and the boot top about 2" higher yet. All plywood should be thoroughly primed with resin sealer to prevent checking.

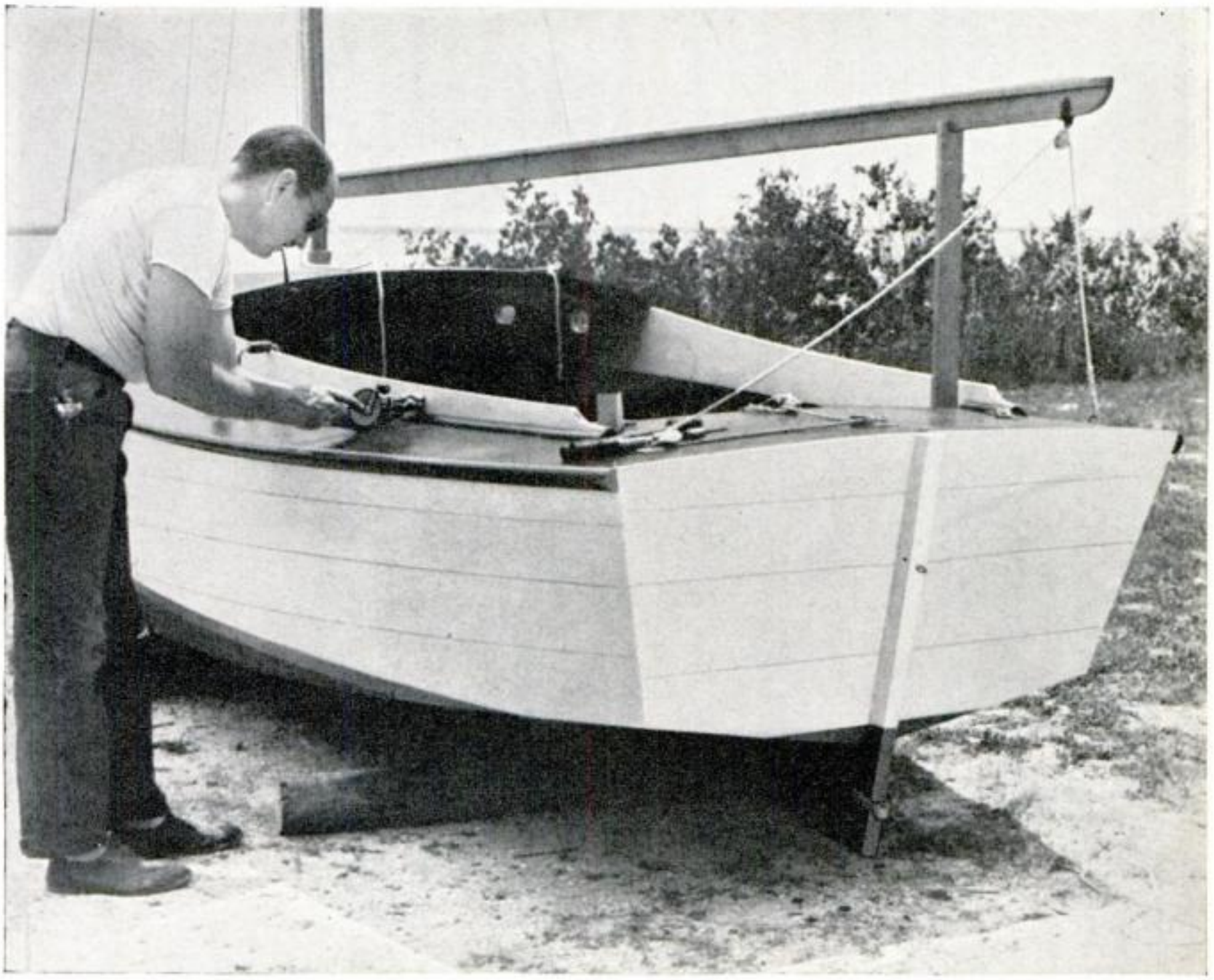
If the boat is to be used in salt water at all, the bottom below the water line should be painted with copper paint; otherwise any good marine paint may be used. The sides may be finished with marine enamel, or with flat paint followed by one or more coats of a good spar varnish. The remainder of the hull can be finished in any manner desired.

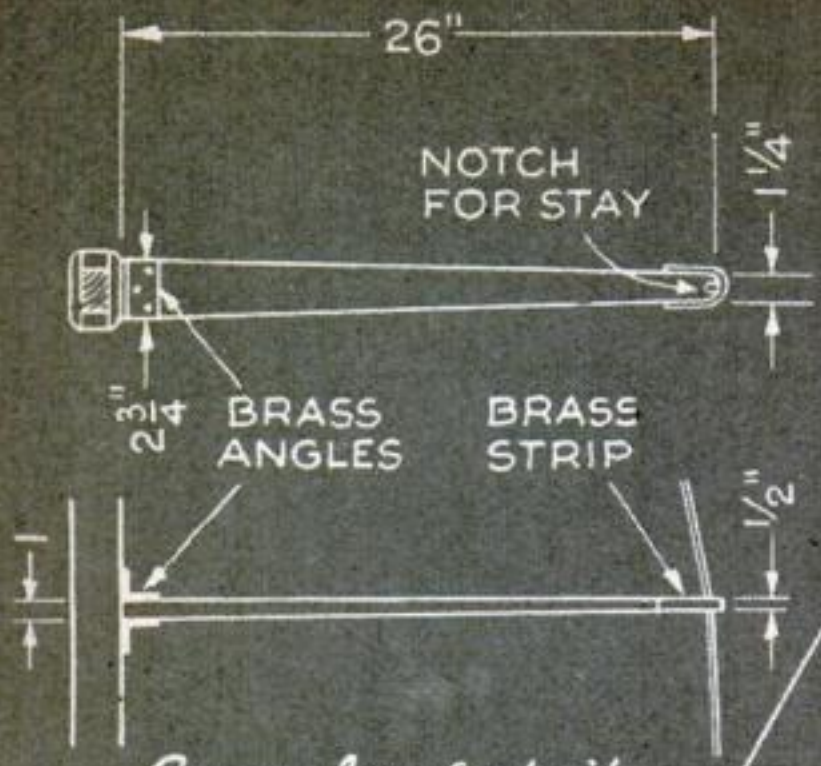
The centerboard can be cut from a sheet of ¼" boiler plate to measurements given in the drawing that appeared in the preceding installment. The ½" centerboard bolt passing through the bed logs should be a driving fit, and washers and marine glue should be used to prevent leaks. When the mast is in place, its rake can be adjusted by the mast wedges driven in the slot in the mast partner. These wedges are shown in one of the accompanying photographs. If the boat is on even keel, the main halyard can be used as a plumb line to determine the proper rake. The wedges around the mast can later be covered with a canvas hood to prevent rain from leaking into the cabin.

The location of all deck hardware, and the rigging arrangement, are shown in the drawings and photographs. The stays are fastened to the mast with brass tangs, and



At right, wedges are used to adjust the rake of the mast and to hold it firmly. The boom fitting also may be seen here. Below, fastening cleats to the coaming to hold the jib sheet

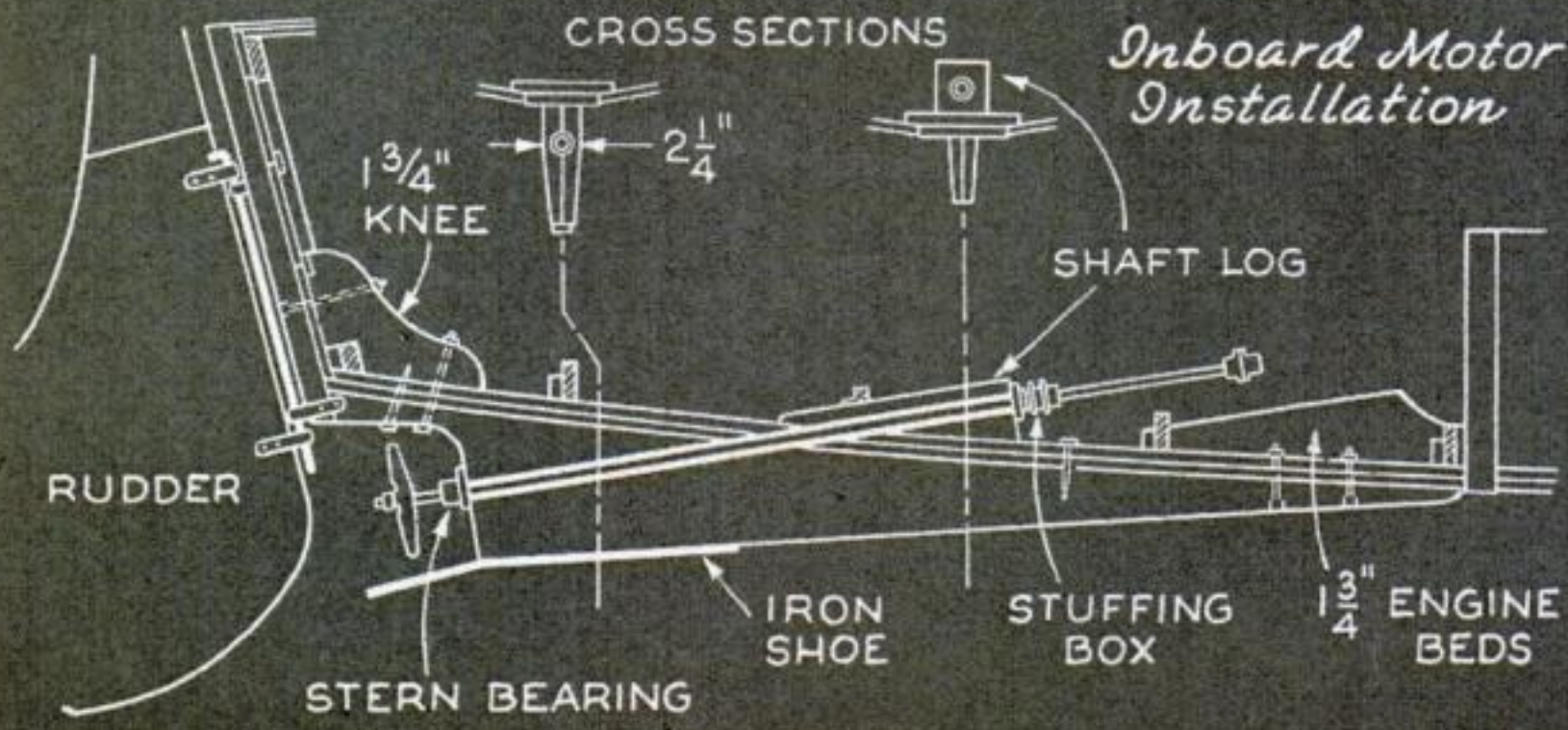




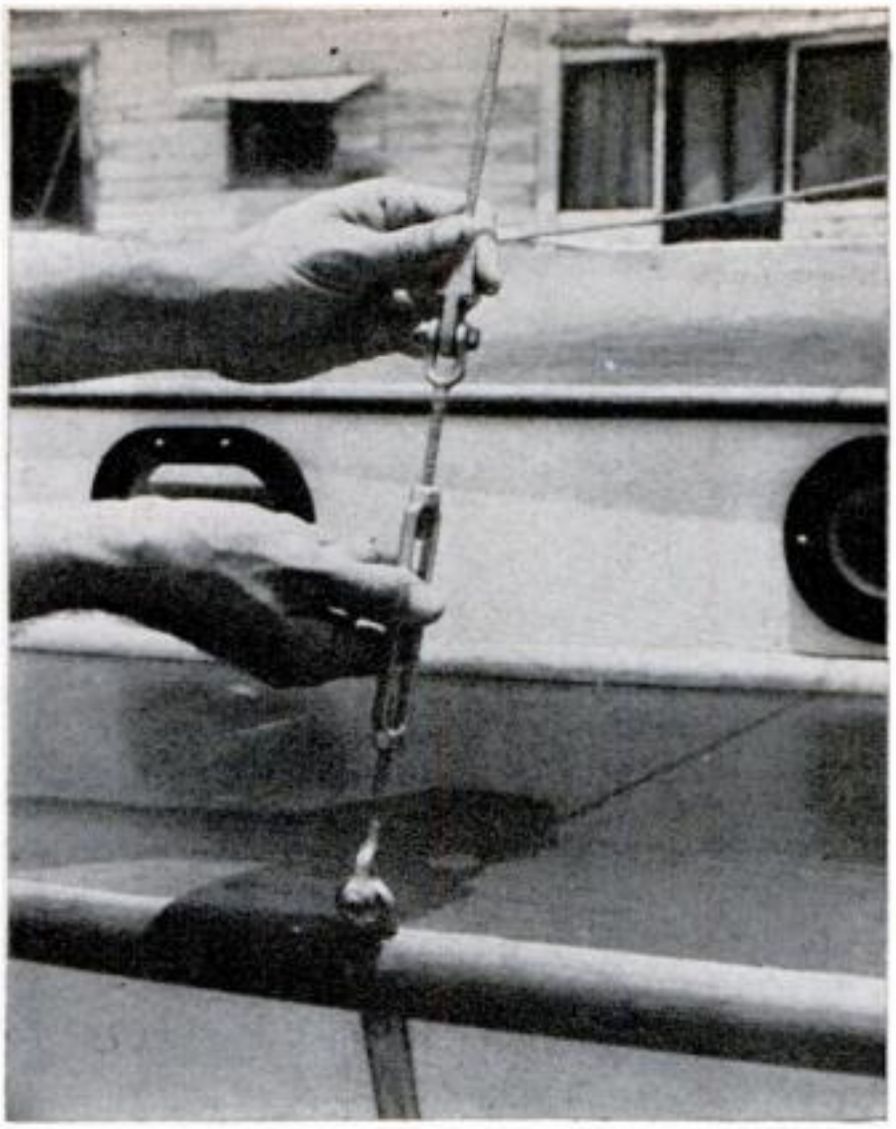
Spreader Details

Alternative Sail Plan

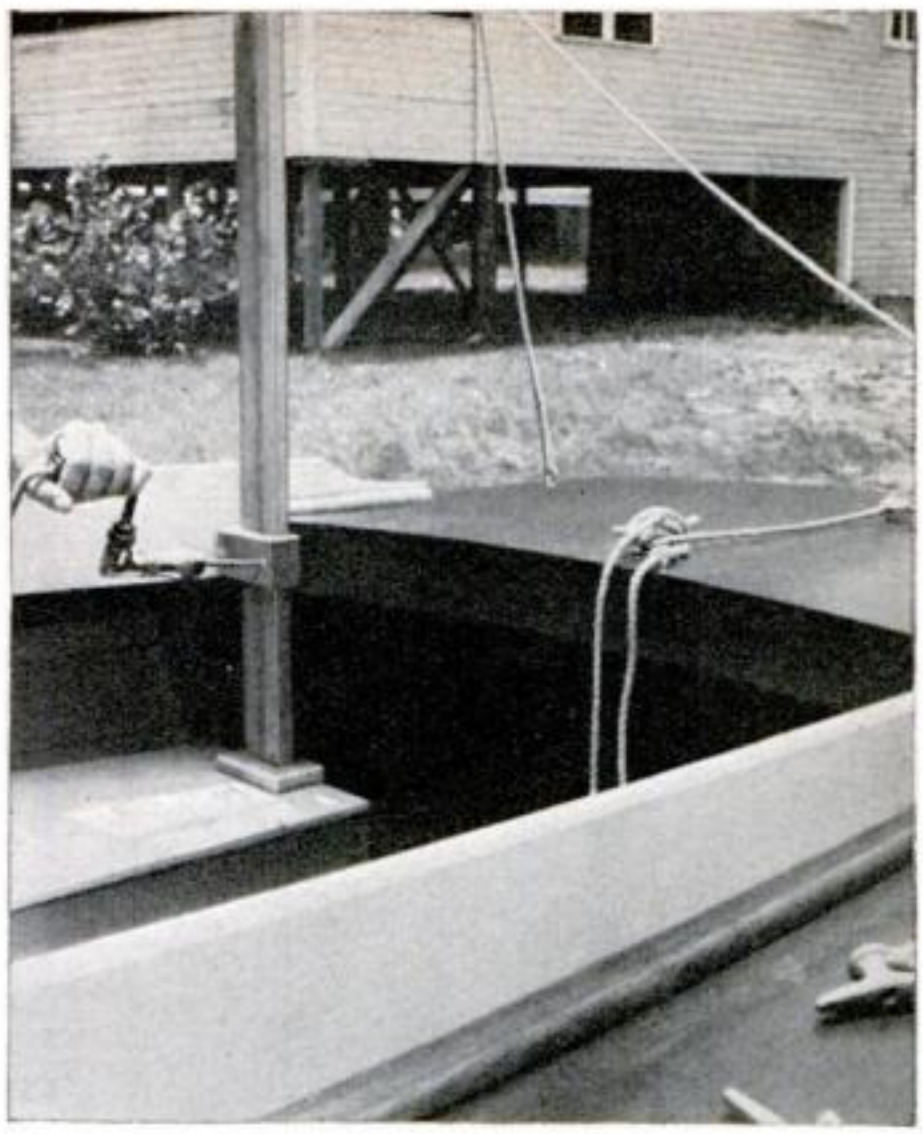
AREA OF LARGE JIB 76 SQ. FT.



Inboard Motor Installation



Stays are fastened by turnbuckles and wire-rope sockets to chain plates screwed fast to the sides

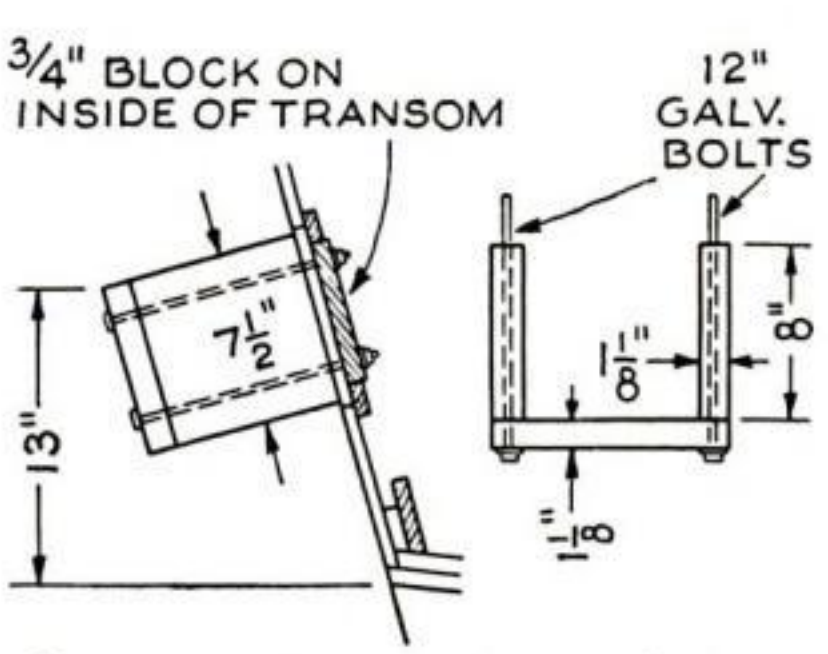


The boom crutch passes through a collar at the coaming and rests in a socket fixed to the seat

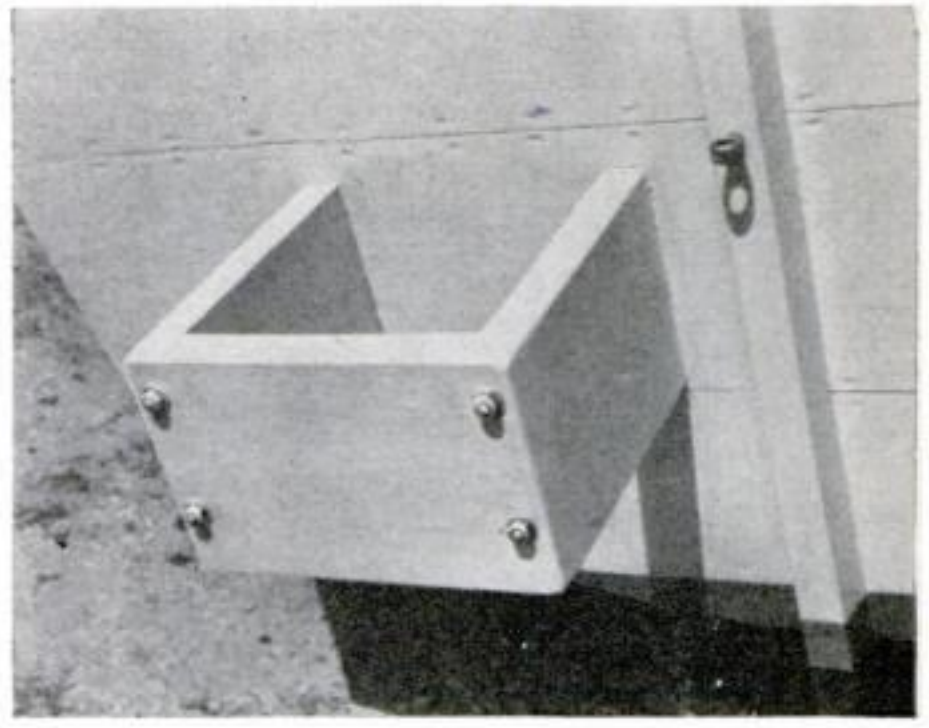
also fastened to the sides and stem with chain plates, which are screwed to the stem and, at the location shown, to blocks inside the planking. It will also be necessary to install blocks under the deck in certain places so that the various pieces of deck hardware can be fastened down, the holding screws passing into the blocks.

The sail track is fastened to the mast and boom with ¾" No. 6 roundhead screws. Wire-rope sockets should be used instead of splicing the rigging rope. Spread the wire rope well apart after inserting in the socket, and then fill the socket with molten lead. A traveler can be used for the main sheet, or it can be rigged as shown in the photographs.

Everything necessary for rigging, if the regular sail plan is followed, was given in the list of materials (P.S.M., Mar. '41, p. 180). This is the sail plan for which drawings appeared in the preceding installment (June '41, p. 173). If the larger sail plan shown in this issue is to be used, extra rigring, tangs, chain plates, wire-rope sockets, sail track and turnbuckles will be required, as will also be a shoulder eyebolt for the jib stay. All these rigging materials can be bought from a marine hardware store. The sails should by all means be ordered from a regular sailmaker.



Bracket For Outboard Motor



The bracket for the outboard motor is offset alongside the rudder gudgeons. Simply and sturdily made, it is held to the transom by means of four galvanized bolts, and can easily be removed when not needed

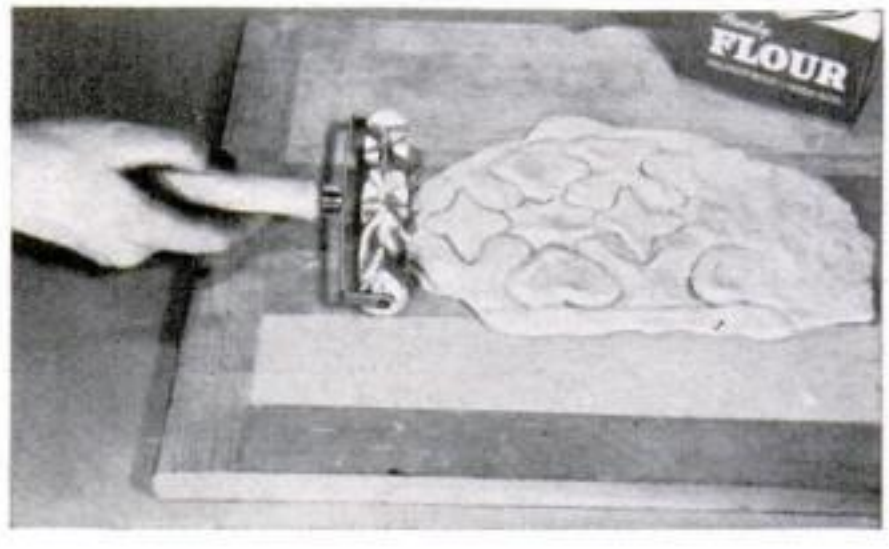
New Appliances

BABY CAN'T TURN this dish over and spill food from it, because it is anchored by a large rubber suction cup. The latter is molded in one piece with a rubber jacket which keeps the contents of the three-compartment china dish warm. The jacket is available in both pink and blue

FOODS CAN BE FROZEN and kept fresh for weeks in a special locker in the new refrigerator shown below. Fifty pounds of meat, vegetables, or fruit can be stored at one time. The main compartment is designed to prevent drying out of uncovered foods

THE NEW EGG COOKER above boils a dozen eggs, poaches as many as five, or boils five and poaches three at once. A whistle blows when eggs are done

SIX DIFFERENT COOKIE SHAPES are cut out as this new rotary cookie cutter is rolled over the dough. Made of aluminum, it is easy to clean



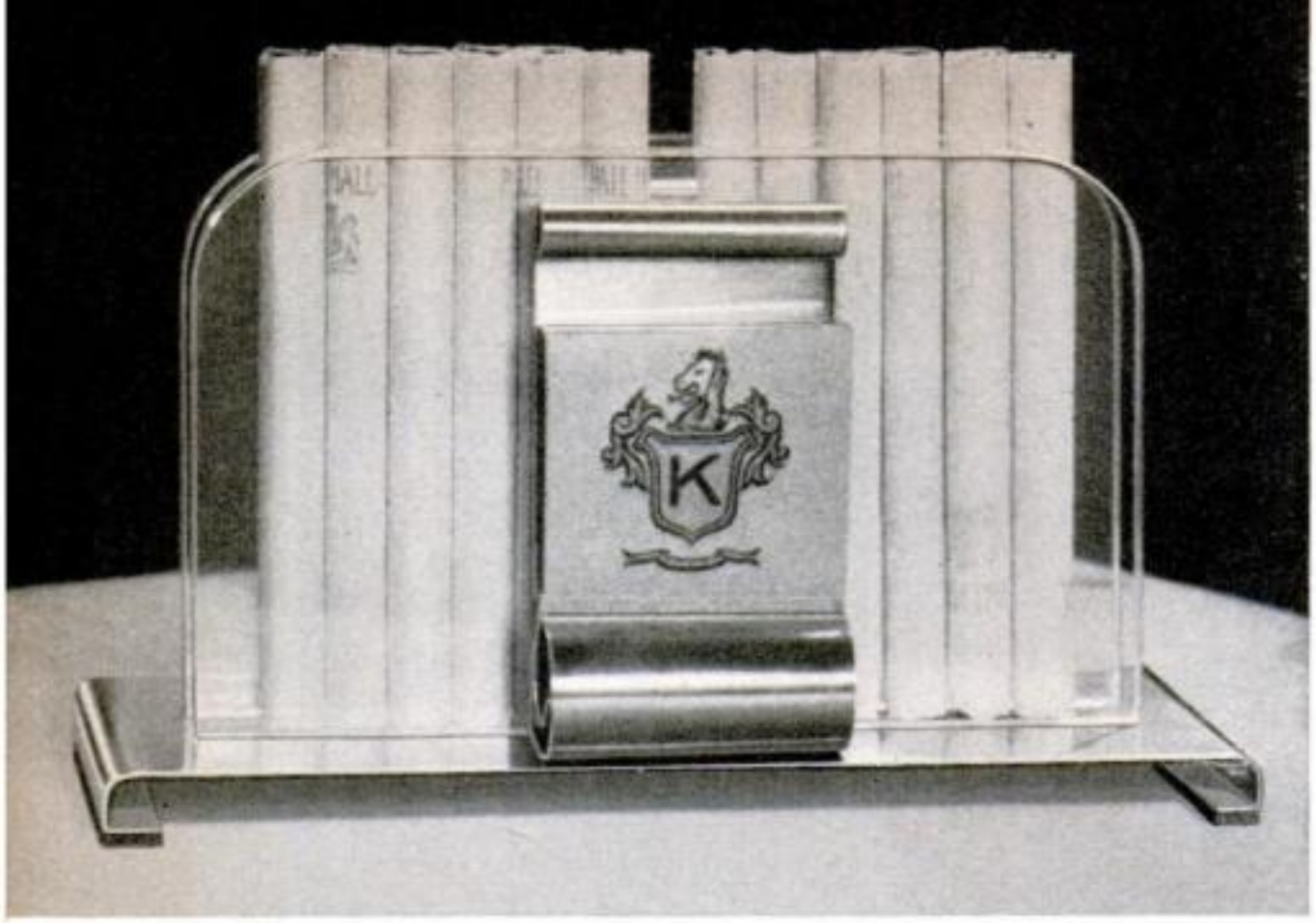
for the Household

A DISAPPEARING TABLE, roomy enough to seat five persons, is convenient in a small kitchen. It slides into a cabinet unit when not wanted. Photographs are from Popular Science on-the-Screen

Perfectly flat when opened out, the table top folds upon itself and can be pushed into the cabinet as below

THE ENTIRE ARM, not the fingers only, operates the new orange-juice extractor shown above. The ridged reamer is pushed around in the bowl, the orange remaining stationary in the hand. Little effort is required. Made of highly glazed pottery, the device is obtainable in four colors

THIS ADJUSTABLE MIRROR is designed for use with one affixed to the wall, medicine cabinet, or dresser to allow the user to see the back of her head from any desired angle. The six-inch mirror is detachable, and the bracket can be swung aside when not in use. Steel parts are enameled in color



This smart smoking accessory is made of crystal plastic and copper

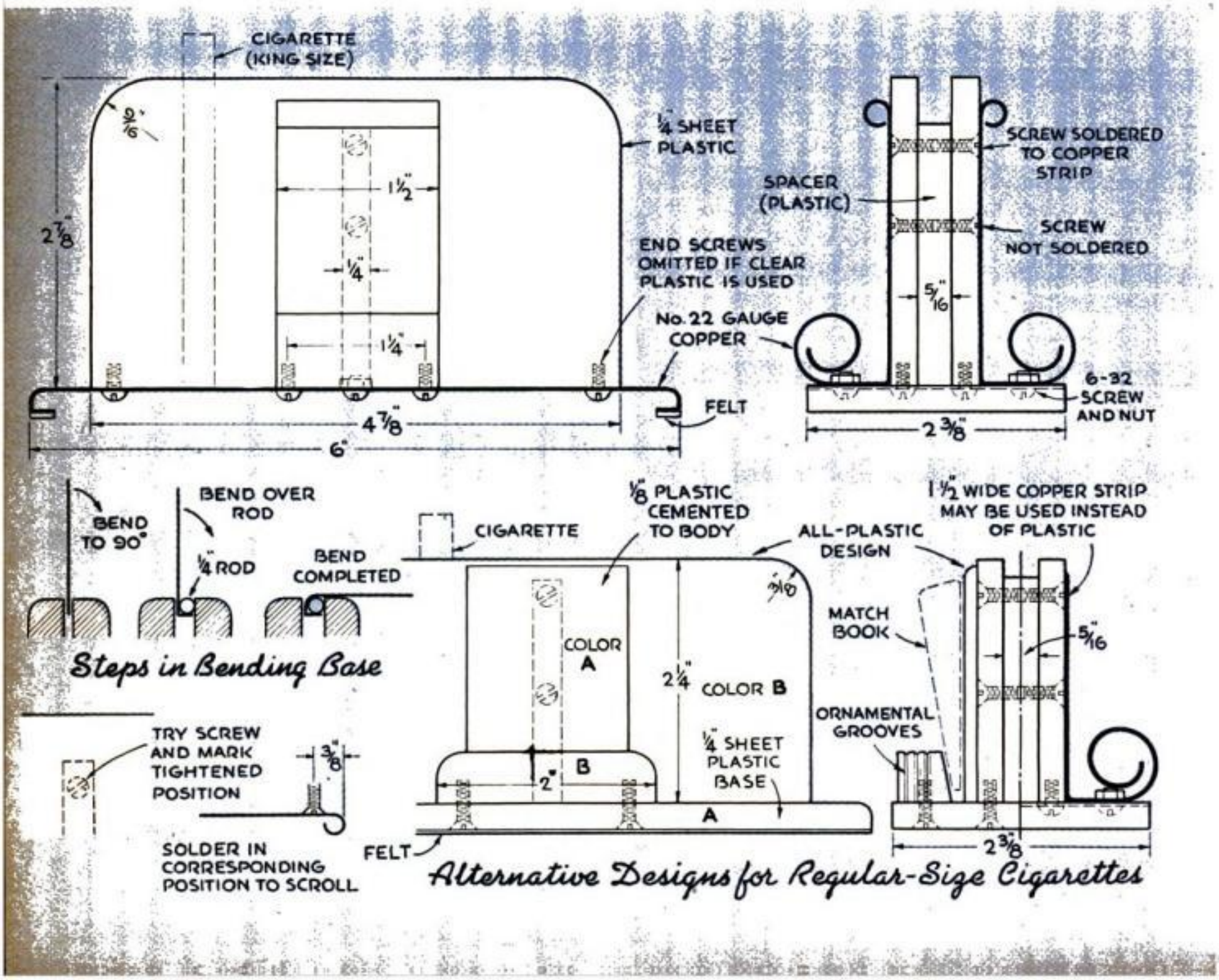
IN CONSTRUCTING this decorative cigarette dispenser, you can use copper or nickel silver with crystal plastic, or with opaque plastic in gay colors. An alternative all-plastic design is also shown.

The sidepieces or uprights are ¼" thick plastic. To insure uniformity in making them, fasten them together temporarily. This is done by applying brown paper to each joining surface with rubber cement, then gluing the paper-covered surfaces together. The parts can thus be shaped, drilled, and countersunk as one piece.

The holes through the face should clear 6-32 screws. Clamp the unit to a wooden block for drilling the base mounting holes squarely into the bottom edge; these are a tapping size for 6-32 screws. Next place the plastic between wood in the vise for tapping. Clear the chips from the tap frequently to avoid breakage. The threads should be run in to a depth of at least 5/16".

Polish the edges by progressive use of 360, 400, and 600 Carborundum paper; then separate and polish both faces of each piece. A high polish is obtained by the use of coarse and fine buffing compounds on separate loosely stitched cloth wheels.

The parallel faces of the plastic spacer must be true and flat. If no 5/16" material



Steps in Bending Base

Alternative Designs for Regular-Size Cigarettes

PLASTIC CIGARETTE DISPENSER

is available for this—and the dimensions must be exact or the cigarettes will fit either too loosely or too tightly—shim up a ¼" thickness with a strip of 1/16" metal or plastic. Tap one hole and screw to one upright. Drill the second hole through the upright (but use the tap size only) for alignment. Clear any burr off the holes before assembling, and check for parallel alignment.

Average Time
6½ hours

The base is shaped from 22-gauge metal or heavier. A brushed finish can be obtained by holding the metal in one direction only against No. 00 emery paper on a sanding drum. For a high polish, use fine steel wool and finish on a buffing wheel. If the base is made of plastic as in the alternative design, the rounded ends can be quickly formed by holding the piece squarely against a sanding drum and moving it through a vertical arc.

The 1½" wide metal strips from which the scrolls are formed should first be polished. Form the upper scroll around a ¼" rod. Mark the position of the upper screws when turned in just flush with the plastic; then remove and solder one in the corresponding position ⅜" below the top of the scroll on each copper piece. Thread the pieces into position on the plastic and mark for the right-angle bend. The large scroll is started around a ⅜" rod. Continue bending to a smooth curve, but allow it to spiral out to the shape shown. Assemble on the base, and drill through the base into the lower scrolls for the hold-down screws.

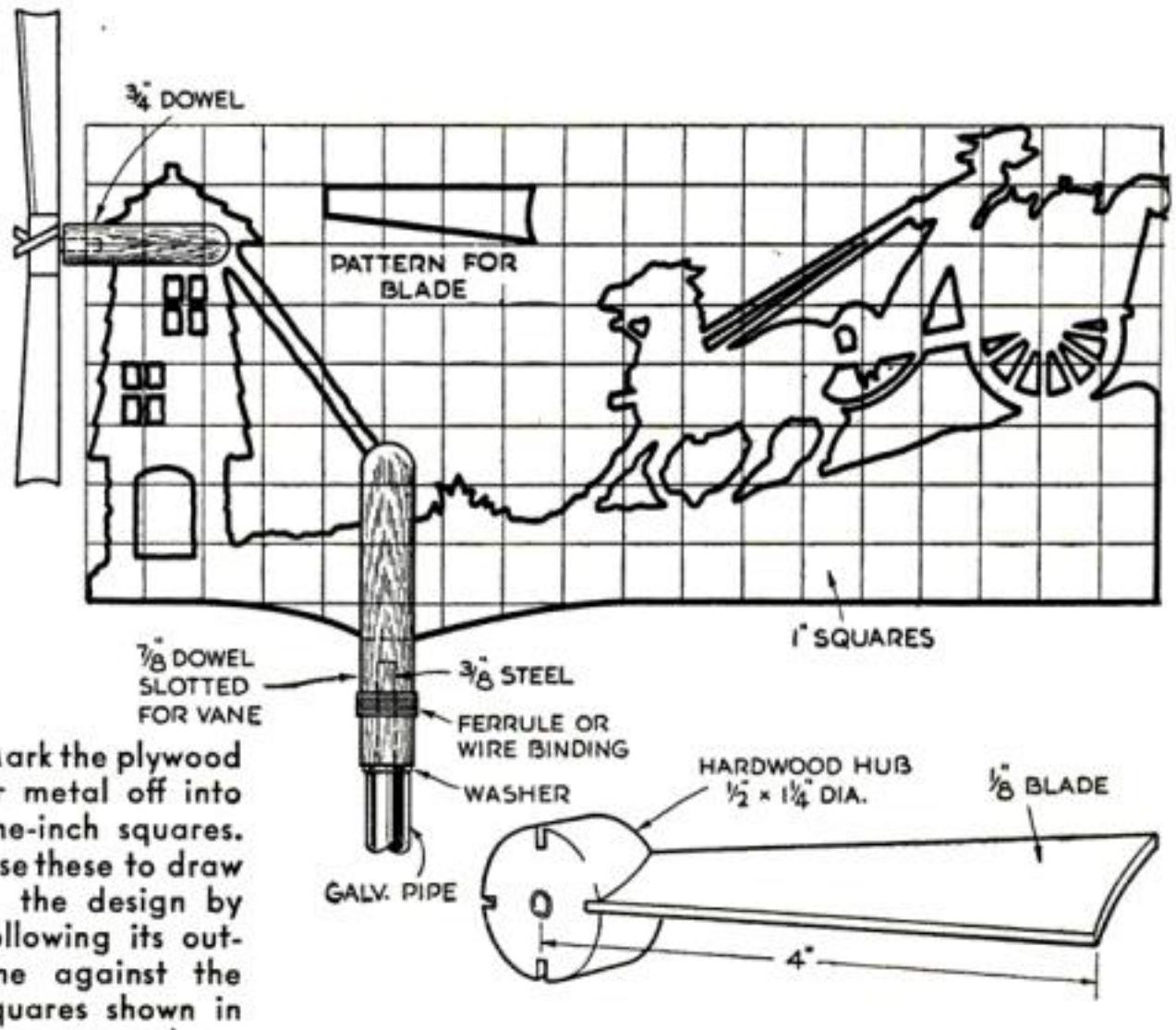
Before the final assembly, all metal parts are cleaned with soap and water and given one or two coats of clear lacquer to prevent discoloration.

In the all-plastic version the rectangular backing piece is cemented to the uprights, over the countersunk screws. Use a marking gauge to lay out the ornamental grooves on the blocks that hold the match books in place, and deepen the grooves with a fine file. Each block is tapped for two screws, which are countersunk into the plastic base.

A suggested color scheme for all-plastic construction is indicated by heavy lettering on the respective parts in the drawing. Black and red, black and ivory, ivory and green are all suitable.—HARRY WALTON.

"Grist to the Mill" Is Motif of Weather-Vane Silhouette

EITHER resin-bonded waterproof plywood or sheet metal may be used for this gristmill silhouette. The four-bladed wheel should be bushed with a short piece of brass tubing, and a steel screw used as the bearing. The wheel mounting is a piece of ¾" dowel, slotted to slip over the windmill. A short piece of ⅞" dowel is similarly slotted and bored to receive a steel rod that serves as the pivot. Use a tight ferrule or wire binding to keep the dowel from splitting. The vane may be painted solid black or in realistic colors, as preferred. The size suggested, 8" by 18", can be increased by using larger squares.



Mark the plywood or metal off into one-inch squares. Use these to draw in the design by following its outline against the squares shown in the pattern above

Five-Piece Desk Ensemble

Designed by
ERNEST R. DEWALT

SIMPLE as they are to make, these five accessories will add a touch of smart modern styling to any home desk or writing table. Mahogany, accented with a bit of oak here and there, was the wood used, but walnut and maple, cherry and ebony, mahogany and walnut, or other woods are suitable. Finish with two coats of clear lacquer and wax, or shellac and wax.

BLOTTER ENDS. Just two wooden clips ¼" by 1⅜" by 11¾", designed to fit a stock size blotter. The underside is rabbeted 1/32" by ⅞", and a cardboard strip is glued to the bottom, leaving a gap into which the blotter will slip. A contrasting inlay strip may be glued into a groove ⅛" by ⅛", cut on a circular saw, if one is available. The corners are gently rounded to the inlay line, which is placed ¼" in from the outer edge. It is best to groove and rabbet a single length and later cut it in half to form the two pieces. Approximate time, 2 hours.

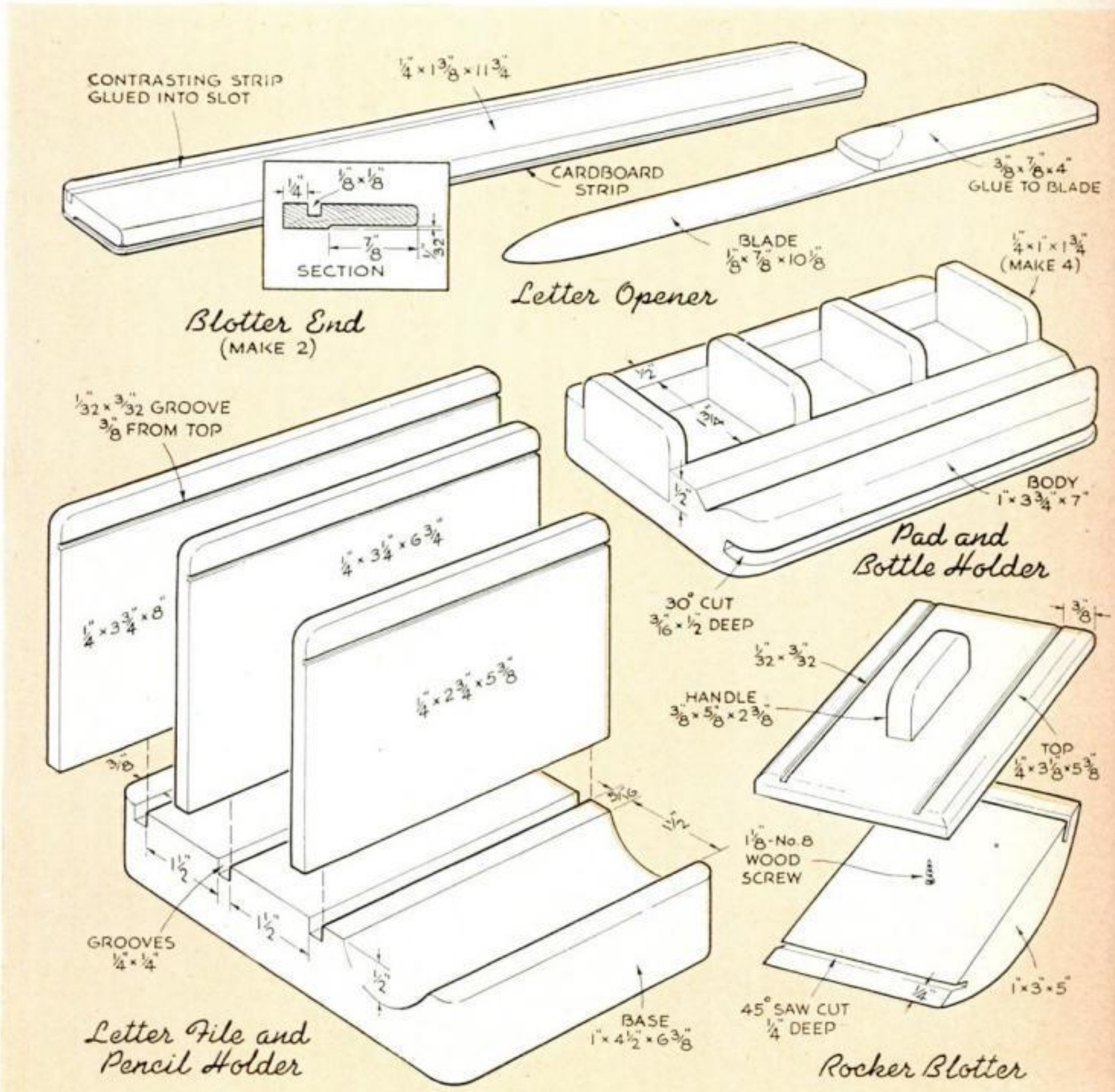
PAD AND INK-BOTTLE HOLDER. The body is 1" by 3¾" by 7". Two or more holders may be made at the same time by treating this part as an elongated molding. Three cuts are needed: 1. A dado groove ½" deep by 1¾" wide, located ½" in from the back. Its width may be varied to suit that of the ink bottle to be used. 2. A V-groove for pencil or pen made with two 45-deg. cuts of the circular saw or by hand. A half-round or V-shaped molding cutter could also be used. 3. A 30-deg. cut 3/16" by ½" deep made with the circular saw to receive a 6" by 9" writing pad. (The pad may be trimmed shorter, if desired.) Four pieces of contrasting wood ¼" by 1" by 1¾" form the three divisions in the dadoed recess. The center pair should be spaced to fit the ink bottle. Paper clips, rubber bands, thumb tacks, or stamps may be kept in the side compartments. Glue in the divisions to fit snugly after the top corners have been rounded. Approximate time, exclusive of gluing, 3 hours.

ROCKER BLOTTER. This consists of three pieces: 1. A rocker 1" by 3" by 5" in length with a curve that may be either band-sawed or cut with a chisel and sanded against a disk. The grooves are 45-deg. saw cuts ¼" deep and ¼" from the ends. The top of the rocker is made slightly convex in the longer dimension to permit passage of the swivel cover over the inserted blotter. Drill a 3/16" hole in the center, and countersink on the curved side for a 1½" screw. 2. A swivel top ¼" by 3⅛" by 5⅜". The pair of decorative parallel grooves are 1/32" deep and ⅜" in from each edge. They are easily made on the circular saw. 3. A handle ⅜" by ⅝" by 2⅜", which is glued and also nailed from underneath. This may be of a contrasting wood, the same as used for the partitions of the bottle holder. Approximate time, 2½ hours.

LETTER FILE AND PENCIL HOLDER. The 1" by 4½" by 6⅜" base has three ¼" by ¼" grooves spaced 1½" apart, and a pencil hollow or recess 1½" wide and ½" deep. For making the grooves, use a dado head or successive circular saw cuts. For the hollow, use a gouge or parallel circular-saw cuts graduated in depth along the required semicircle. Sand the hollow smooth. All four corners of the base are rounded. The vertical divisions are ¼" by 2¾" by 5⅜"; ¼" by 3¼" by 6¾"; and ¼" by 3¾" by 8". Each is accented by a 1/32" deep groove placed ⅜" from the top. Assemble without glue so that the divisions can be removed for easier cleaning. Approximate time, 2½ hours.

LETTER OPENER. The oak blade is ⅛" by ⅞" by 10⅛", shaped to a sharp point and sanded thin at the edges. The handle is ⅜" by ⅞" by 4" and should be of a contrasting wood. Partially shape the handle and glue it to the blade. After the glue has set, form and sand the end. Approximate time, 1 hour.

This desk set, rich with the natural beauty of contrasting woods, will harmonize with any furnishings



NAUTICAL LAMP

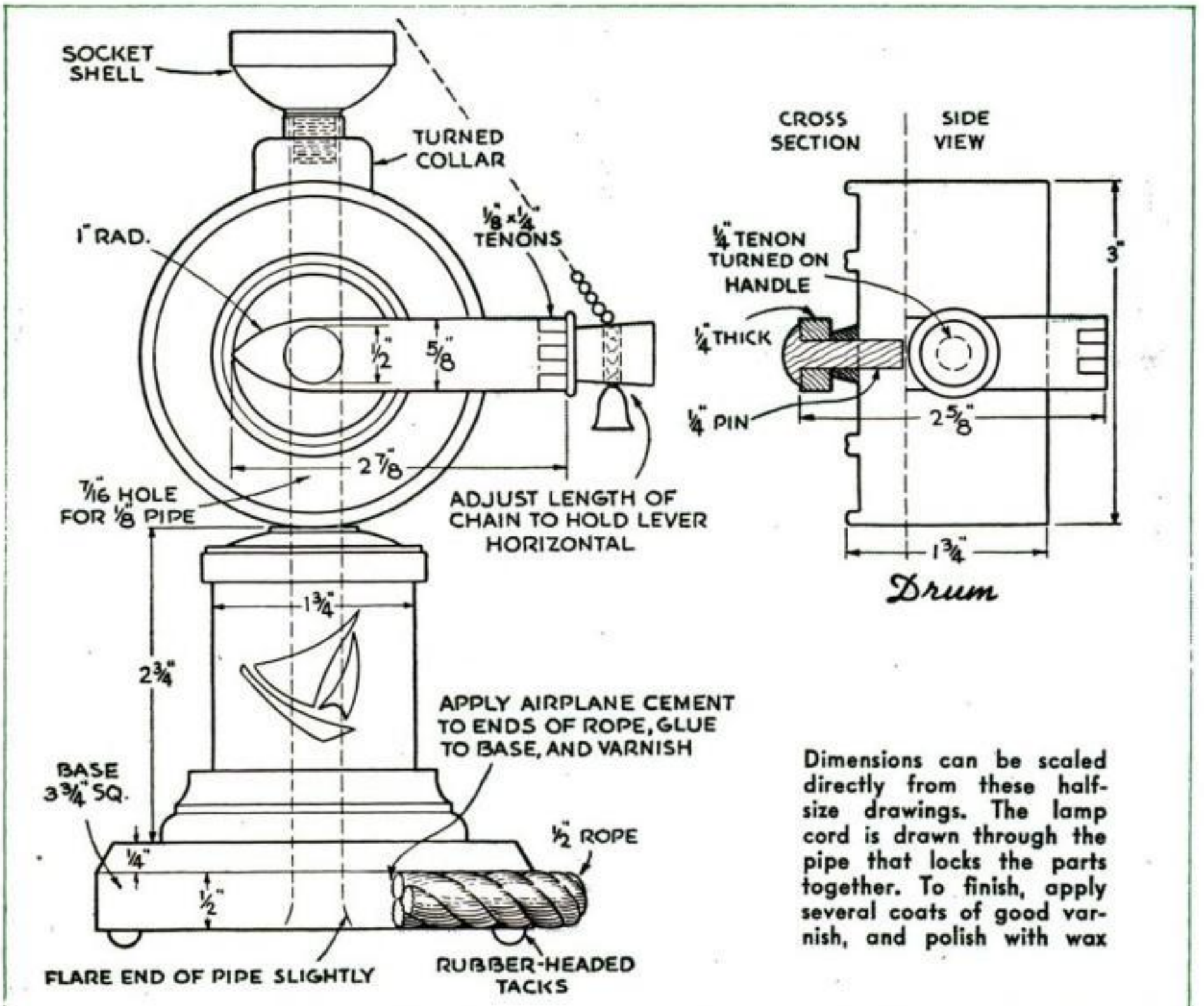
RESEMBLES ENGINE-ROOM TELEGRAPH

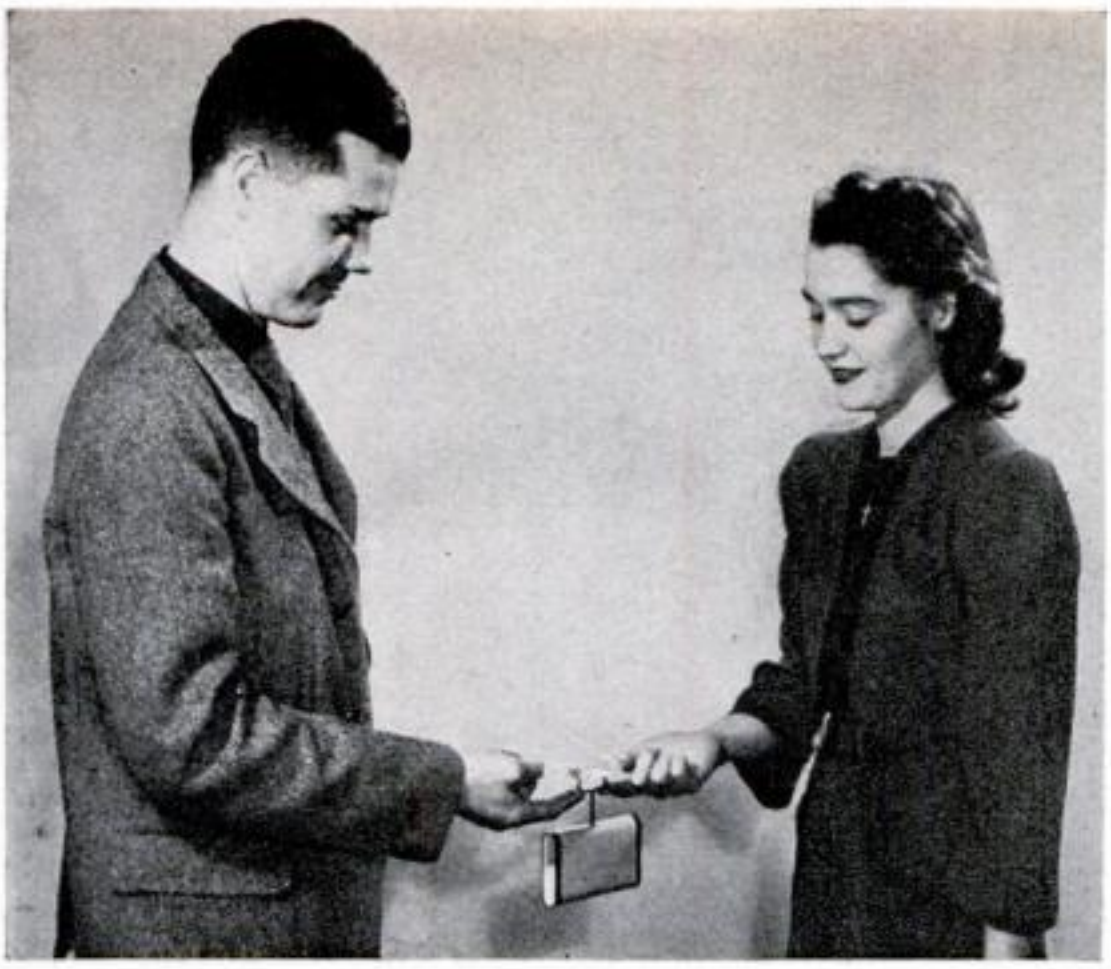
Clocked Project

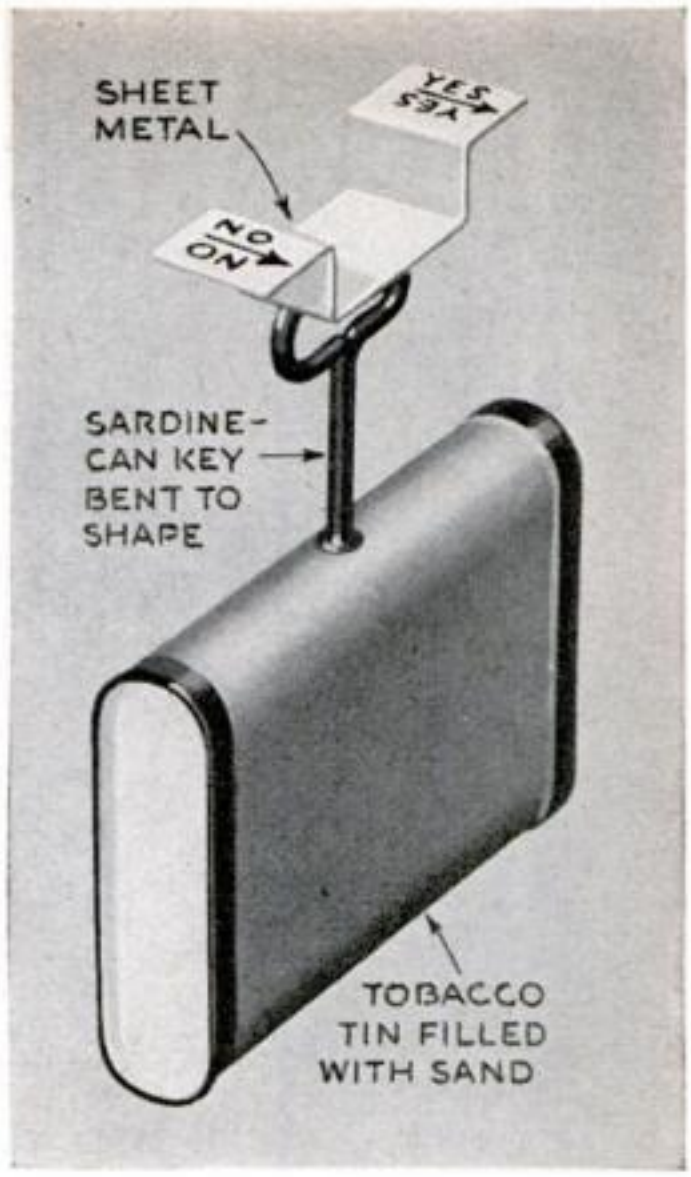
Average Time
6½ hours

SIMPLE enough for the beginner to make, yet sufficiently novel to interest the experienced woodworker, this nautical lamp can be completed in about two evenings. It will make a pleasing companion piece to the nautical match holder previously described (see P.S.M., June '41, p. 181).

Maple or other close-grained turning stock may be used. As the drawings below are exactly half size, dimensions may be taken directly from them by doubling all linear measurements. The square base is beveled on top and centerdrilled for the ⅛" pipe that holds the parts together. Either flare the lower end of the pipe or use a thin lock nut by counterboring the hole from the bottom for about ⅛". An ordinary threaded lamp-socket shell is screwed to the upper end and locks the assembly together. The design may be cut from thin plastic or colored celluloid, and either inlaid or cemented in place. Rubber-headed tacks hold the base off the table surface so that the lamp cord may be brought out. The base may be made round if preferred.—BRUCE MACINTOSH.







The uncanny way in which this simple contrivance seems to respond to questions will intrigue everyone. Note in the detail at the right that both the arrows point in the same direction

Tobacco-Tin Whirligig Answers Questions

HERE'S fun for your next party. This odd little device, which anyone can make in about one hour, answers both spoken and unspoken questions and even at times seems to prophesy the future. It is sure to amuse at any gathering, especially if the questions are shrewdly put.

The body is merely a pocket tobacco tin filled with sand or gravel, although it could also be made of wood. Its weight should be about ¾ lb. Into it is soldered or driven a large house key or a sardine-can key with an oval head. To the top of the key is soldered a bent strip of sheet metal marked as in the accompanying photograph.

Two persons support the device on their forefingers as shown. They must take care their fingers do not touch the shaft of the key; in fact only the very tips of the fingers should be used. The arms must be extended and not touching the body. The experimenters should stand erect and pay close attention to the question asked. They must also have it impressed clearly upon them that the indicator will turn toward their left to indicate "yes," and toward their right to signify "no."

At first, ask aloud something that can be indisputably answered with "yes" or "no," such as, "Is there a war going on abroad?" In a second or two the tin should swing about, as though the shaft of the key were its pivot, in the direction of the arrow indicating the proper answer. After some practice, more doubtful questions may be asked, and some operators will find it possible to obtain answers even to unspoken queries.

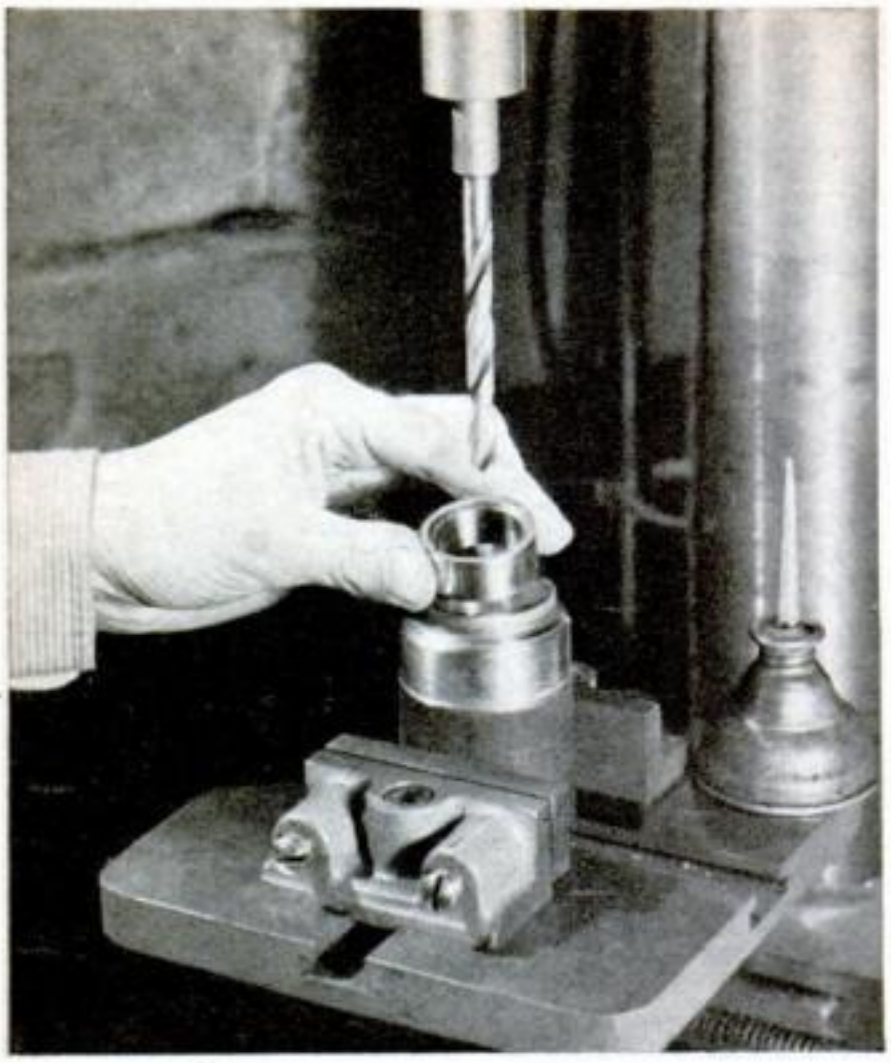
Although this is only a stunt, psychologists account for it on the accepted principle that the entire body is involved in the process of thinking. The tobacco-tin whirligig amplifies unconscious muscular movements on the part of the operators, and makes these visible.—JULES L. NATHANSON.

Inexpensive Milk Strainer Disks Filter Paint for Spraying

MILK strainer disks, costing only a few cents a hundred, are excellent for filtering small quantities of paint, enamel, and other finishing materials that are to be sprayed. They will filter out finer particles from the paint than a cheesecloth strainer.—G. B.

Realistic Eyes for Small Figures Made of Toothbrush Handles

EYES for carved Scottie dogs and similar animals and birds can be cut and filed to shape from transparent colored toothbrush handles. Cemented into shallow holes, the eyes gleam in the light.—C. M. SMITH.

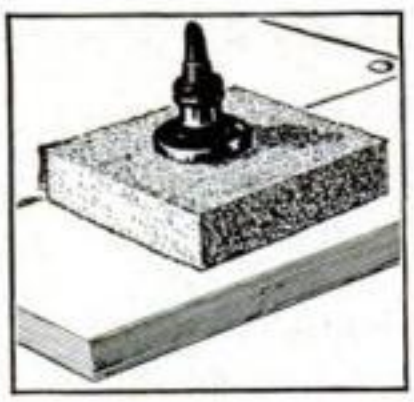


Putty Knife Stirs Lacquer and Paint in Small Cans

LACQUER, enamel, or paint in a small can is difficult to stir with a paddle without wasting some of it. A better way is to set the can on a rubber mat or a piece cut from an old inner tube and stir the contents by spinning a round-handled putty knife between the palms of the hands as shown. This method is particularly useful for mixing auto touch-up colors where no mechanical mixer is available, as in the small garage or shop.—LEO M. KNASKY.

Magnetized Bushing Retains Lubricant for Drilling

A HARDENED steel bushing that has been magnetized makes an excellent retaining ring for drill-bit lubricant and is superior to the washers sometimes used. The bushing should, of course, be larger than the drill employed. Magnetize it by stroking it across one pole of a strong permanent magnet or D.C. electromagnet. The bushing will cling to the surface of iron or steel, and the drilling lubricant cannot escape.—W. E. B.

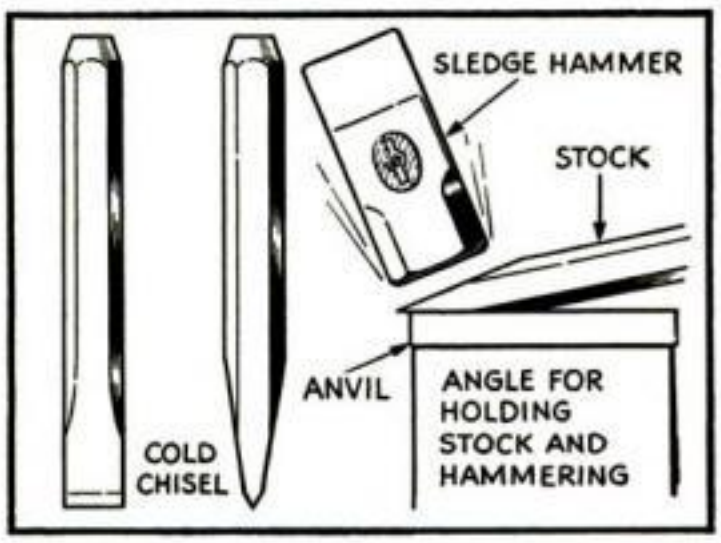


Sponge Rubber Forms Nonskid Bottle Holder

BY SETTING an ink bottle into a piece of sponge rubber, it can be kept from sliding off a tilted drawing board, and the sponge also serves as an excellent penwiper. Cut a hole in the rubber and push the bottle not quite all the way through.—NORMAN DALY.

FORGING A COLD CHISEL [*METAL WORKING*]

Tool steel suitable for cold chisels, cape chisels, punches, and drift pins may be bought from many hardware stores or from any blacksmith shop.



Hexagon or octagon tool steel is preferred, although old round or square files make excellent chisels. Tool steel should never be worked when above a bright-red heat, nor forged when the heat has dropped below a dull red.

Forge the taper of a chisel evenly on both sides by holding the steel at an angle on the anvil as shown. Placing the steel close to the edge of the anvil permits the hammer to overhang the edge of the anvil, which results in a fine point on the chisel. As the point thins, the metal spreads; to remedy this, the chisel is placed on edge on the anvil and forged to size.

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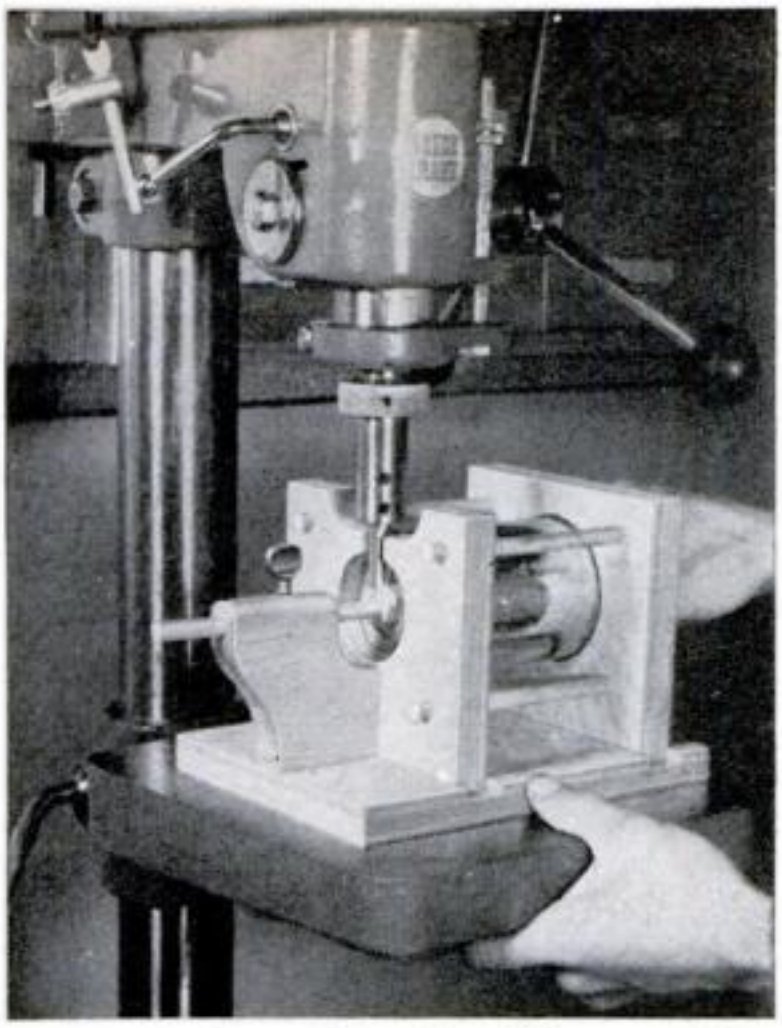
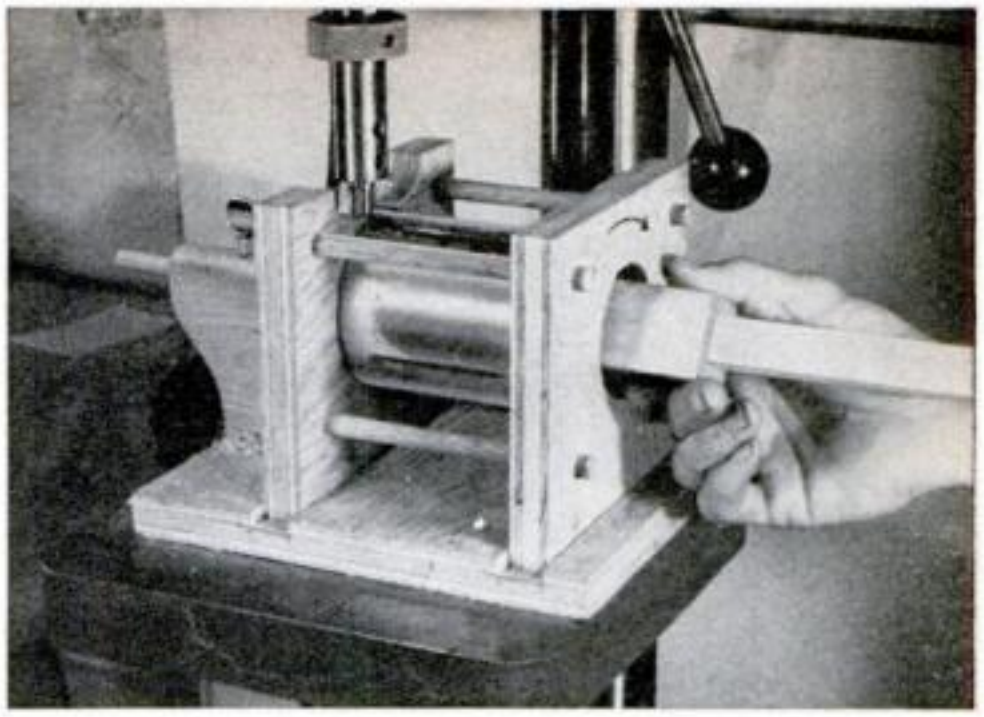
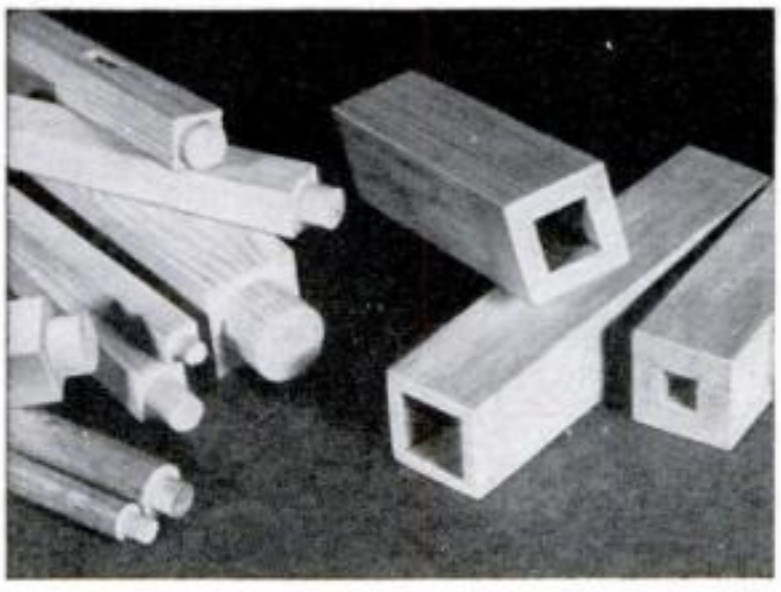


The jig is clamped to the drill-press table. To produce square shoulders on the tenons, the router bit must be accurately centered



Stock should always be turned against the rotation of the bit, as indicated by the arrow in the photo above

Some finished tenons and three bushings appear below. The latter accommodate either round or square stock. Make several sizes



Dowel Tenons Are Speedily Turned in Special Drill-Press Jig

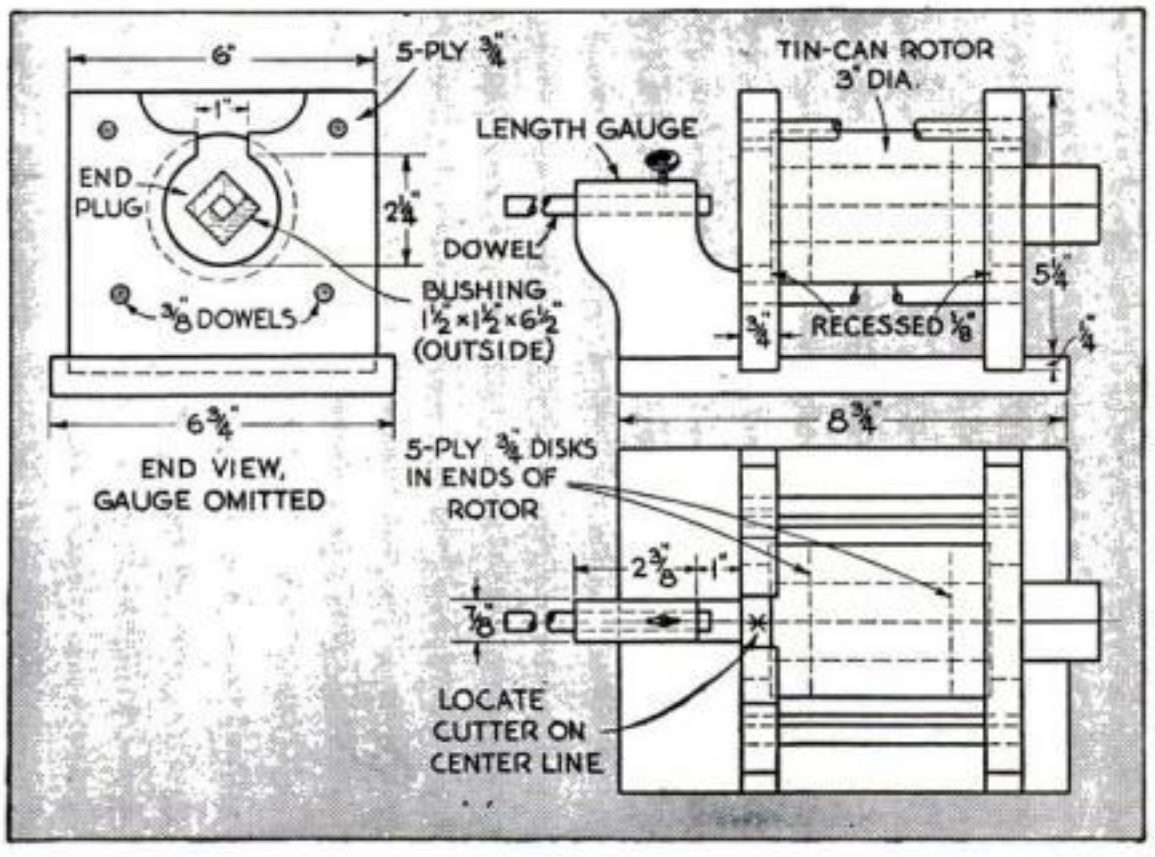
WITH the aid of the homemade jig illustrated, a drill press can be used to turn dowel tenons on either square or round stock. This is much quicker than using a lathe, especially for chair rungs and other quantity work.

The jig, which must be bolted to the drill-press table, will accommodate stock up to 1½", round or square. The work is supported in wooden bushings of suitable size, which fit snugly into the rotor. The latter is formed from a tin can, with both ends cut out and ¾" thick plywood disks substituted for them. Each disk has a 1½" square hole, carefully centered. The rotor is held, free to turn, in a circular recess in each end piece.

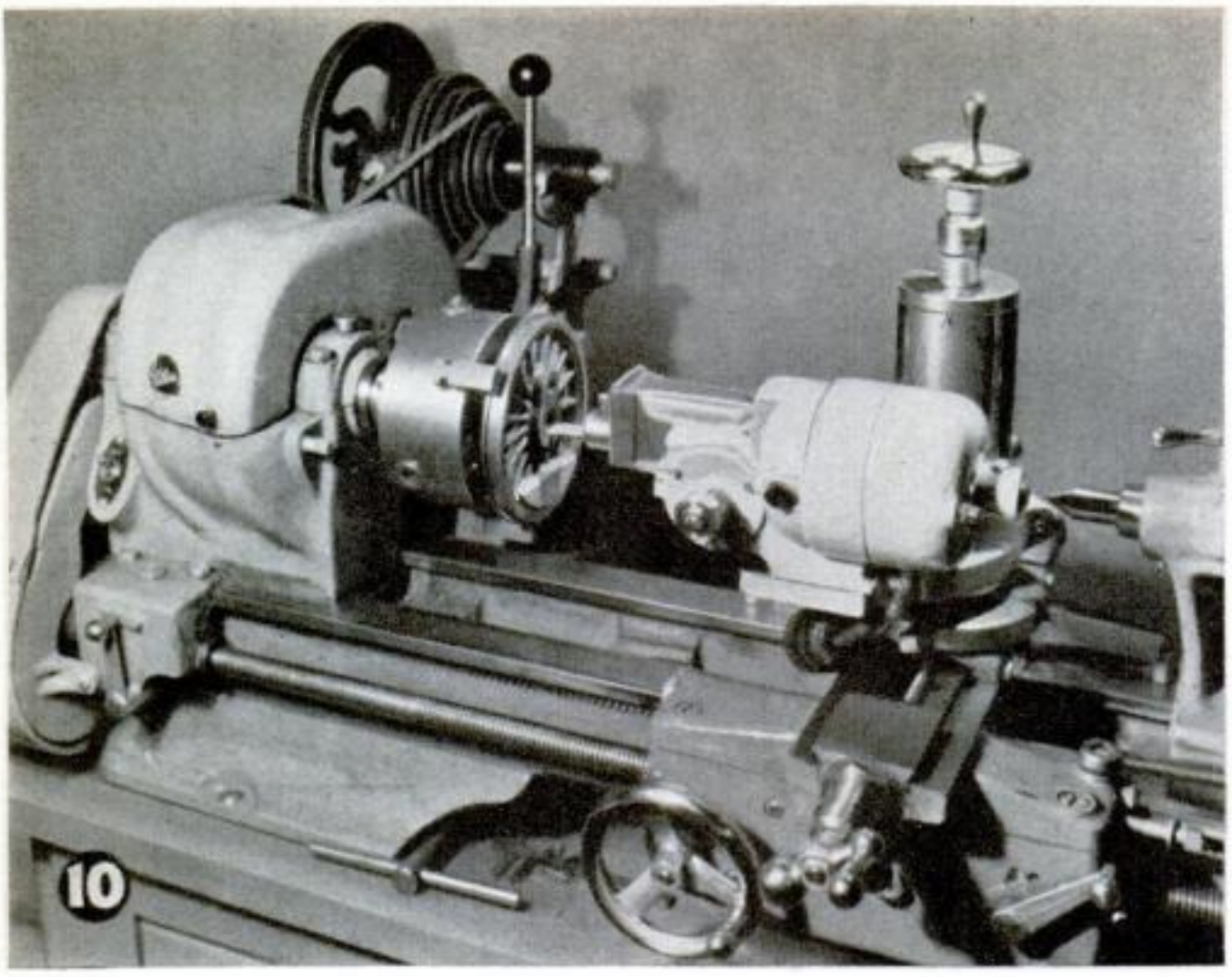
To avoid shrinkage, it is advisable to use plywood for all the wooden parts except the dowel-tenon length gauge and the bushings, which are best made from well-seasoned maple or birch.

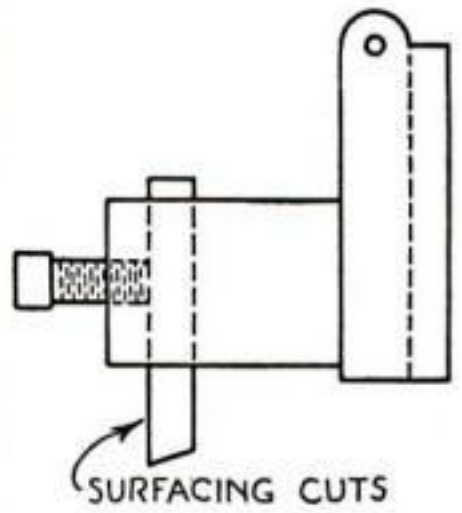
The bushings may be made from four pieces of material, but two L-shaped pieces of wood are more easily kept square while being glued up.

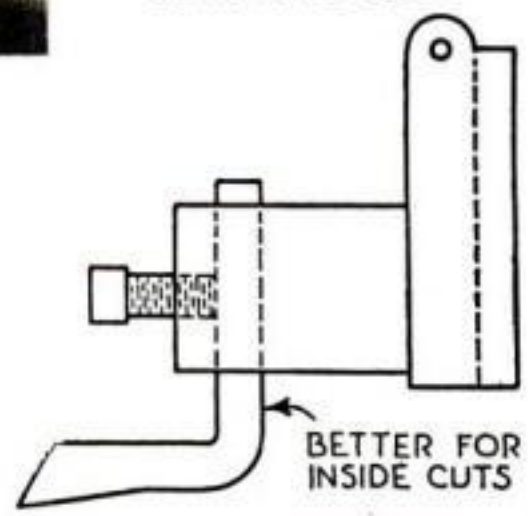
The length of tenons is governed by the length gauge. When, however, you wish to make a tenon 1" long and possess only a ½" router bit, two cuts will have to be made. Be sure to turn the stock against the rotation of the tool bit, as shown in one of the accompanying photos.—R. O. LISSAMAN.



Plywood disks are pressed in flush with ends of rotor, which turns in recesses, as shown in the side view







Slide-Rest Shaper

PART TWO—BY C. W. WOODSON

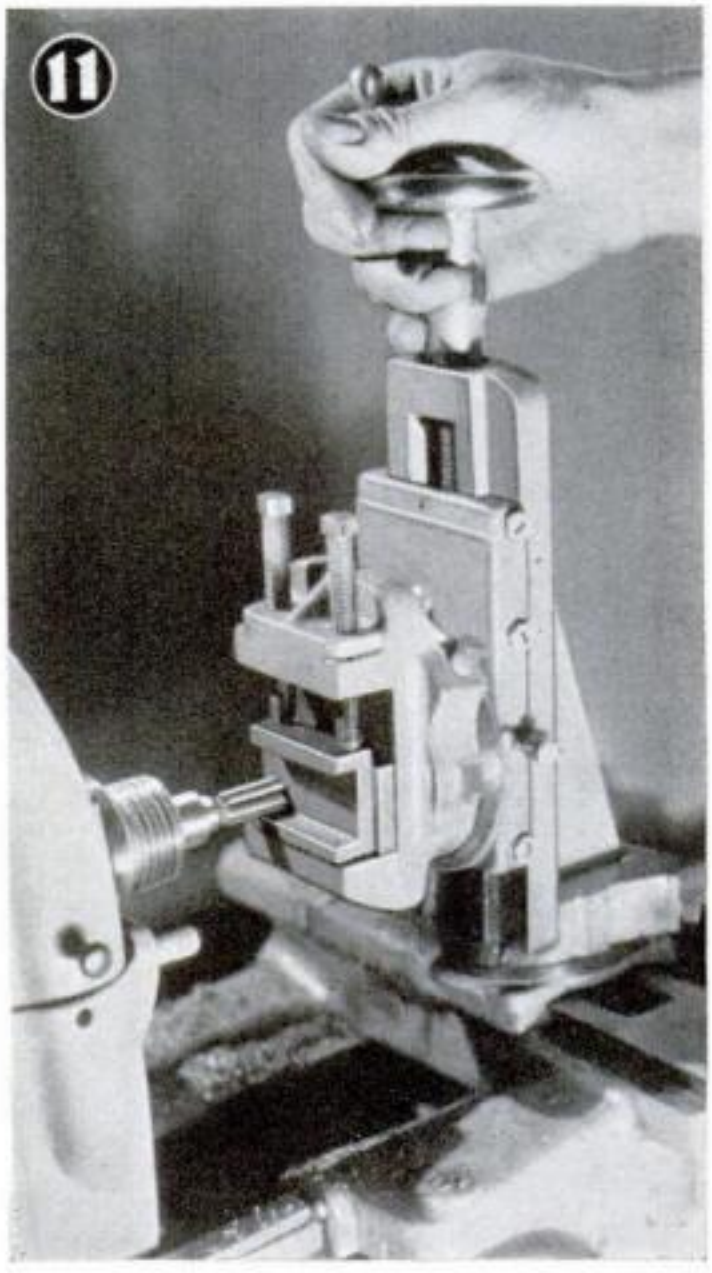
IN THE construction of our versatile, timesaving shaper attachment for a small lathe (Figs. 10 and 19), the next part to be machined is the clapper box. This is made from solid steel to the dimensions as shown in the drawings that appeared in the preceding installment. The box is cut with an end mill in the milling attachment as in Fig. 11 and brought to final shape with a file.

The tool holder is turned in the lathe and riveted to the clapper, Fig. 12. The ¼" square tool-bit hole is cut by drilling a ¼" hole and filing it square. A hole is also drilled and tapped for a small hardened set screw to clamp the tool in place. If three holes are drilled in the clapper box and four in the end of the ram, the box can be set vertically or at several angles, which is often an advantage.

Either a solid piece of steel may be used for the crank, or it may be built up. As the ram has a 1" stroke, the crank throw is ½". Two holes are drilled and tapped for set screws to hold the crank securely to the motor output shaft. Details of this part may have to be changed to fit the motor available.

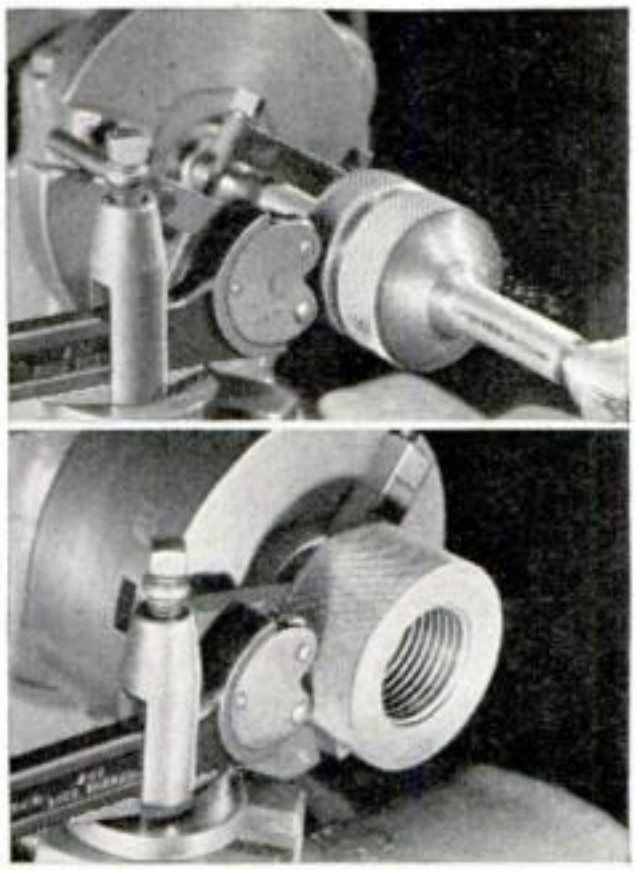
The supporting column with its vertical adjustment assembly is shown in Fig. 13. This consists of a solid steel shaft fastened to a disk for mounting on the lathe, a sliding tube, and a screw and handwheel assembly. The steel shaft is chucked and supported by a steady rest, the end faced smooth, the screw hole drilled clear through, and the square threads cut for a distance of 1¼" with a specially ground tool bit.

Next, the shaft is reversed in the chuck, Fig. 14, the



KNURLING IN THE LATHE

[LATHE WORK—14]



Knurling, which may be done with fine, medium, or coarse knurls, requires a slow back-geared speed. To knurl steel, use oil liberally. Brass and cast iron can best be knurled dry. On work wider than the knurls, start at the right or tailstock end with a heavy feed and allow the longitudinal feed to carry the tool over the work several times, setting the tool deeper each time until the knurling is complete. Never withdraw the knurl from the work until the knurling is finished. Considerable pressure is necessary to produce good knurling, and for this reason the tailstock center should be properly adjusted and well oiled.

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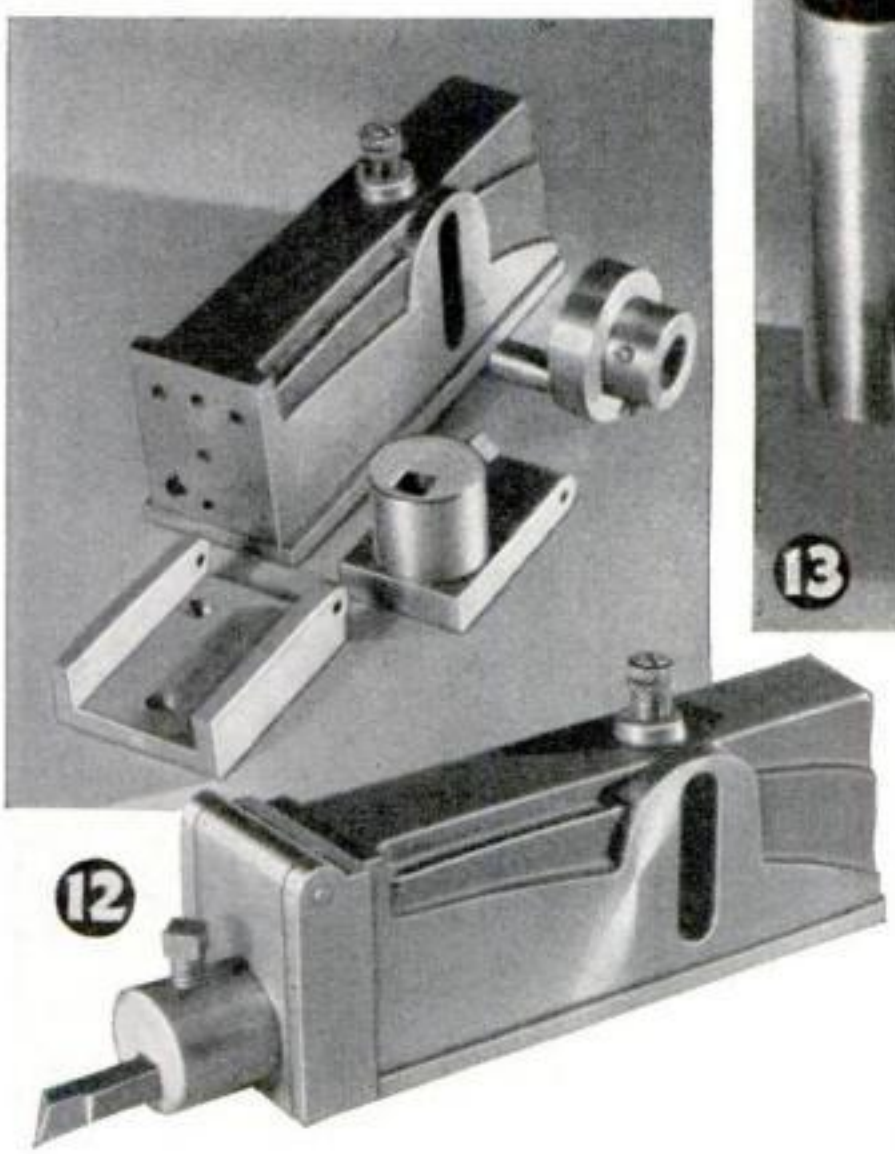
screw hole bored to clearance size, and a recess bored in the lower end for mounting on the lathe cross slide. This part can easily be changed to fit any lathe by duplicating the method of fastening the compound rest.

The lower end of the shaft is shouldered down for ⅝" to a press fit into the disk that forms the column base. This disk is made from a short end of steel shaft 4½" in diameter, turned to size, faced smooth on top and bottom, and bored to take the shaft end, Fig. 15. Two holes for the hardened clamp pins and set screws are drilled 90 deg. apart and tapped ⅜"-16. The shaft is then forced into the disk in an arbor press. This could be done in a husky vise or with a soft hammer. The lower end of the hole in the disk was beveled slightly when being bored, and a short lip was turned on the shaft for riveting over, as is shown partly done in Fig. 16. This makes the part almost as strong as though it were turned from the solid.

13

The brass tube, which is a nice sliding fit over the shaft, is chucked as in Fig. 17, and the ends are faced true. A short key is riveted in the lower end to fit a keyway milled in the shaft as shown in the drawings. This prevents the attachment from turning. The tube cap is made from steel, turned, drilled, and tapped as was indicated in the drawings.

An adjusting screw and handwheel can be made up as shown or simplified, as desired. The handwheel may be turned from solid stock and knurled and fastened with a



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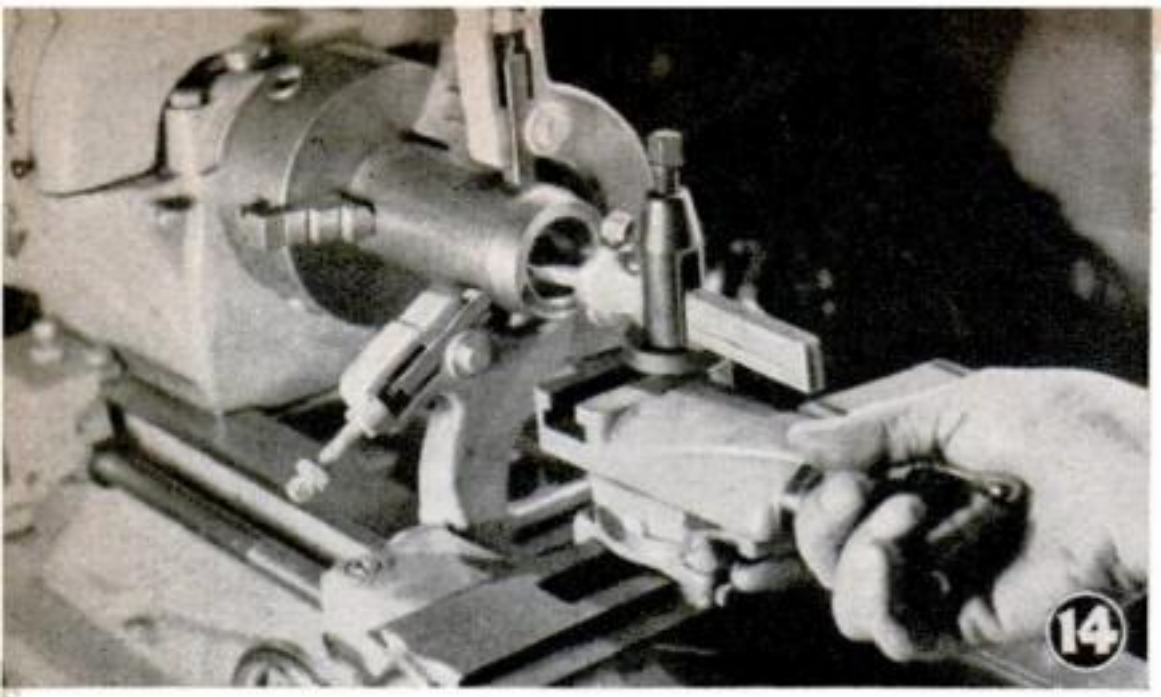
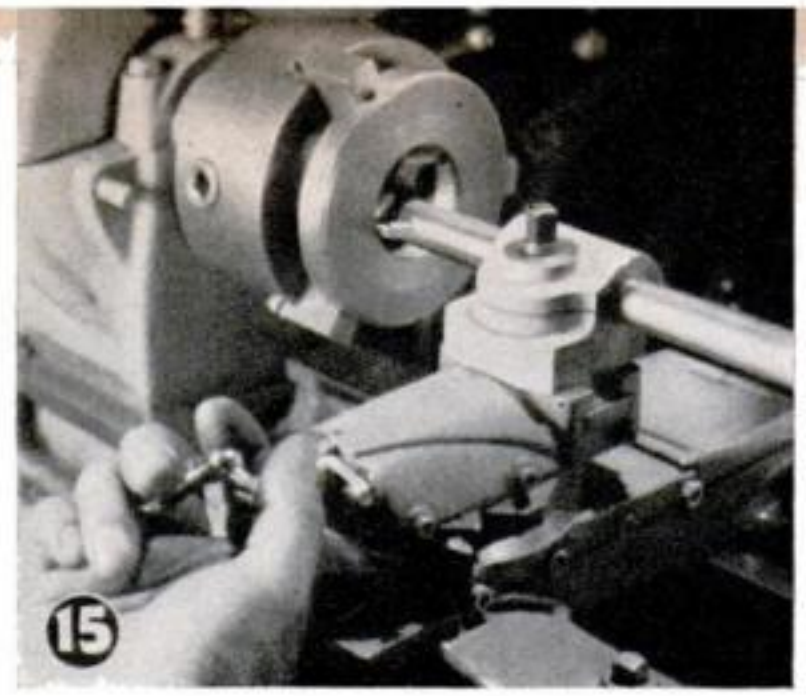
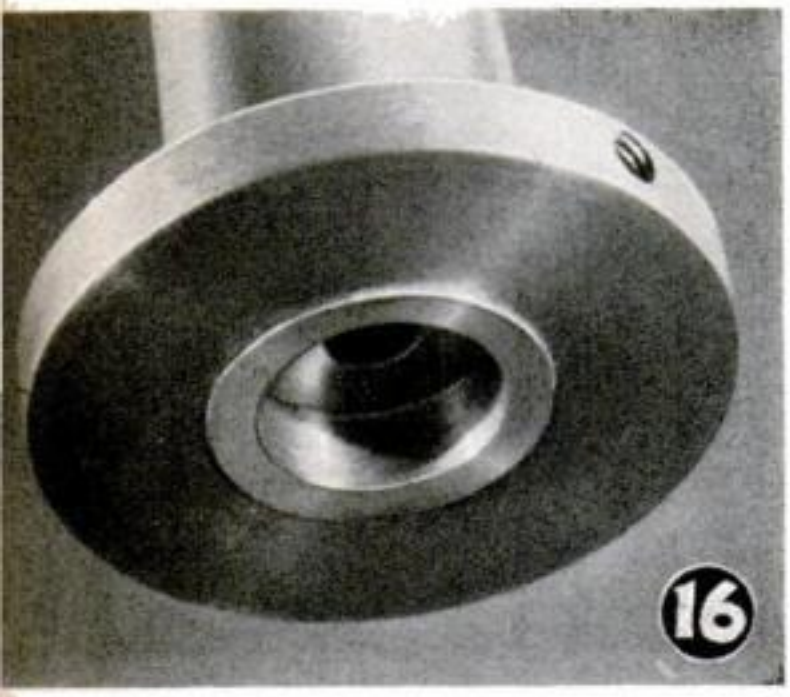
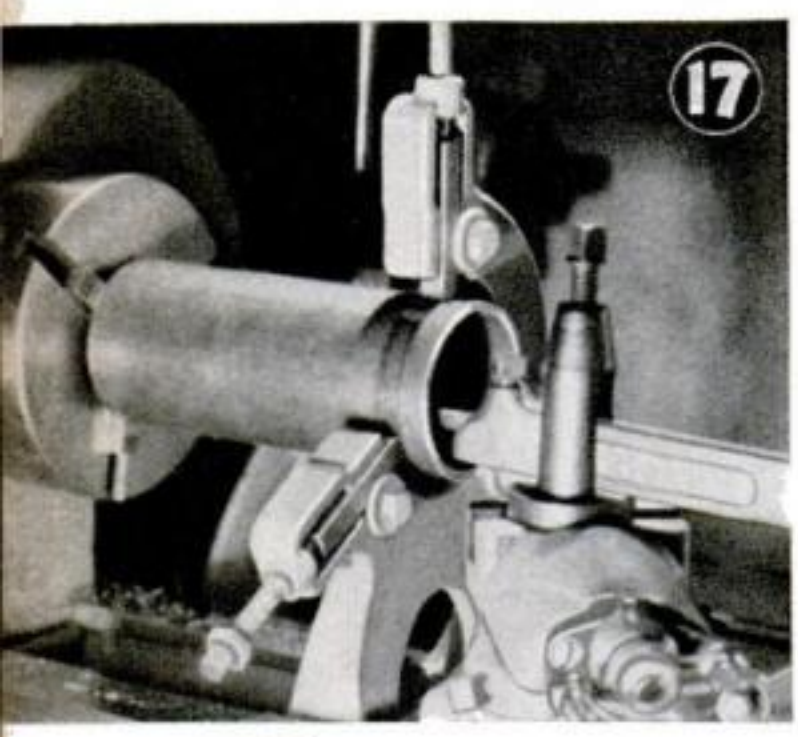








set screw or pin instead of the Woodruff key. If a suitable wheel can be obtained from another machine, it may be used, saving much time in making this part.

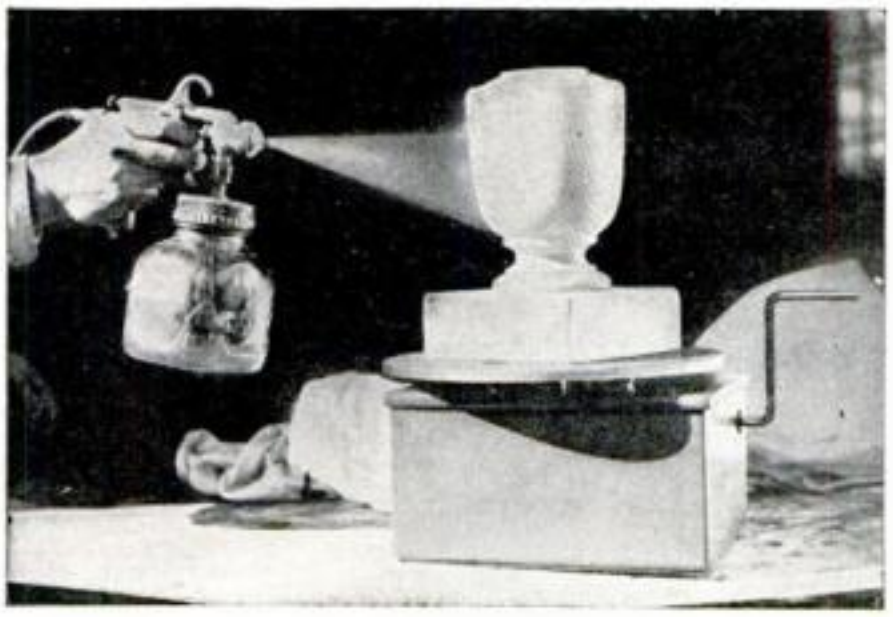
For best results, the threads of the adjusting screw should be cut left-hand. These are as easy to cut as right-hand threads if the work is done in the lathe. A tap and a die cutting National form threads could be used, but square threads will wear longer and be more satisfactory. The adjusting screw may be made from cold-rolled steel or drill rod. It should be center-drilled on both ends and turned between centers to the dimensions in the drawings.

In cutting the left-hand square threads, a specially ground tool bit is required, flat on top like a cut-off tool, but ground at a slight angle so as to follow in the thread groove, as shown in the sketch. It is important to use plenty of oil on the work when cutting threads. Many passages of the tool with a very fine feed will give smoothest results. When the threads have been cut full depth, they can be polished smooth with crocus cloth.

The adjusting screw guide, shown at *A* in the drawings, is turned from a bar of steel, drilled, threaded, and cut off at the one chucking. The collar *B* is made from the same stock in much the same way. This may be left plain or engraved into 100 divisions, the same as micrometer collars on lathe feed screws. All these parts are shown in Fig. 18.

This completes the machine work, and the attachment can now be mounted upon the lathe ready for a trial. On a preceding page are drawings of three types of tools for use with the shaper. The first of these will do a variety of work, but for certain cuts the other tools shown are superior. A second tool holder with a transverse hole is required for these. Made up as a unit with its own clapper box, it can be substituted for the other in a moment. Equipped in this way, the little shaper handles many odd jobs.

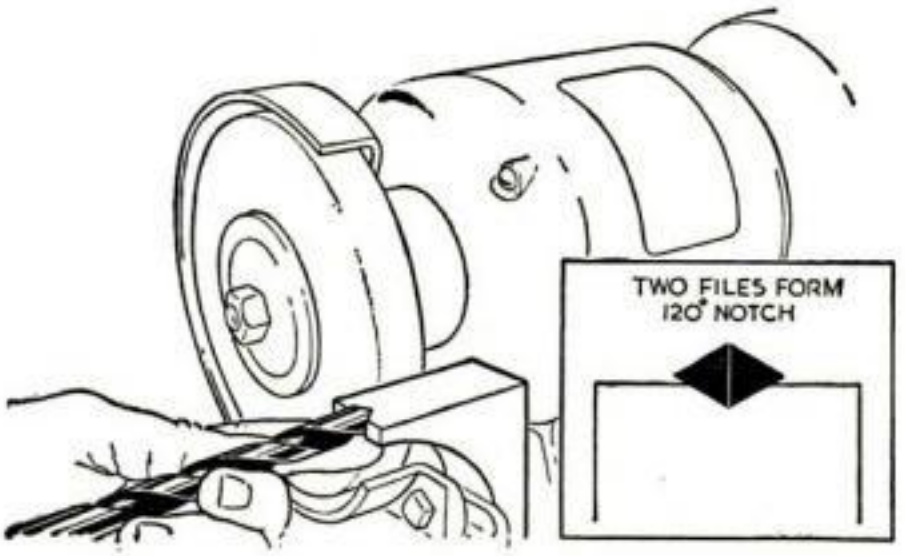
Painting Turntable Made from Spring-Wound Phonograph Motor

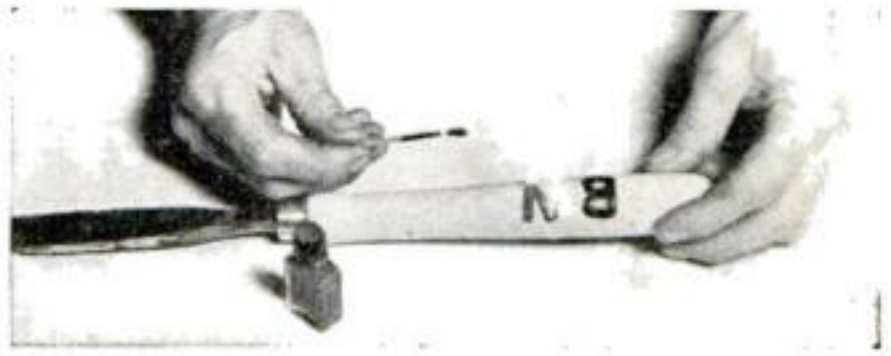


WHEN spray-painting small articles on which a smooth, even finish is important, it is possible to do better work if the pieces are placed on a phonograph turntable. Heat the projecting shaft red-hot with a blowtorch to draw its temper, then cut off or file it flush with the turntable surface. Alternatively, a plywood disk slightly thicker than the height of the shaft might be slipped over it. A box is built around the motor. The regulator will be found convenient for altering the speed of rotation. One advantage is that the device can be used outdoors for lacquering.—MAURICE KAINS.

Notch Checks Angle of Drills

A 120-deg. V-shaped notch, filed in the end of a tool-grinder rest by means of two triangular saw files held firmly together as below, is convenient for checking the angle of drill lips when sharpening these on the wheel.—W. C. W.



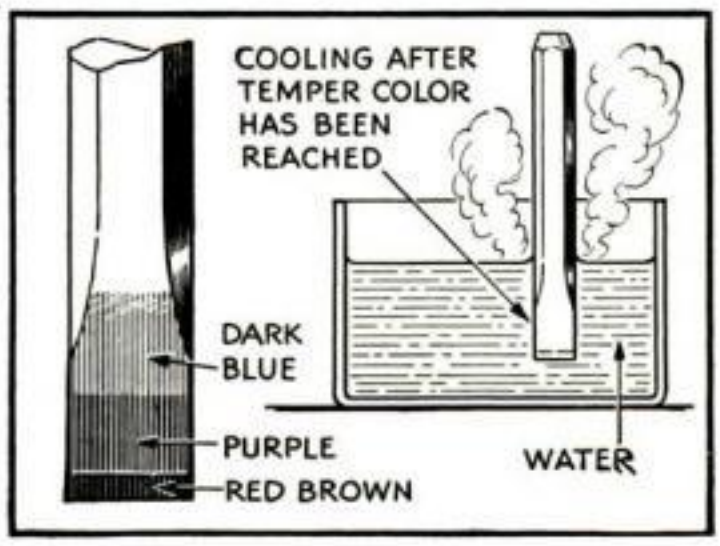


Wooden Tool Handles Branded with Finger-Nail Polish

INITIALS and other marks can be burned into wooden handles or other wood surfaces with finger-nail polish. Paint on the desired letters or figures with a small brush, and immediately touch a match to the polish. When it has burned away, rub the surface with a cloth. The marks can be made deeper by repeating the process.—B. N.

HARDENING A COLD CHISEL [*METAL WORKING*]

1. Place the forged chisel in the fire, bring it up to a bright red color, and quickly plunge it entirely into a pail of water (not too cold). Leave until cold. 2. Grind the edge and do any necessary dressing. 3. Polish the point for about 1½" back from the edge with emery cloth. 4. Tempering may be done with a blowtorch by heating the chisel about 2" up from the cutting edge, or by placing the head of the chisel in the forge fire. Keep the point out of the flame. The heat will travel towards the point until it reaches the polished part. The first color to appear there is light yellow, then brown, red, purple, dark blue, and pale blue. For metal working, the tip should be dark brown for about 1/16". 5. As soon as the brown color reaches the tip of the cutting edge, it must be immediately plunged into water or oil. Do not dip the entire chisel when tempering, as this would harden the body, which might then break.



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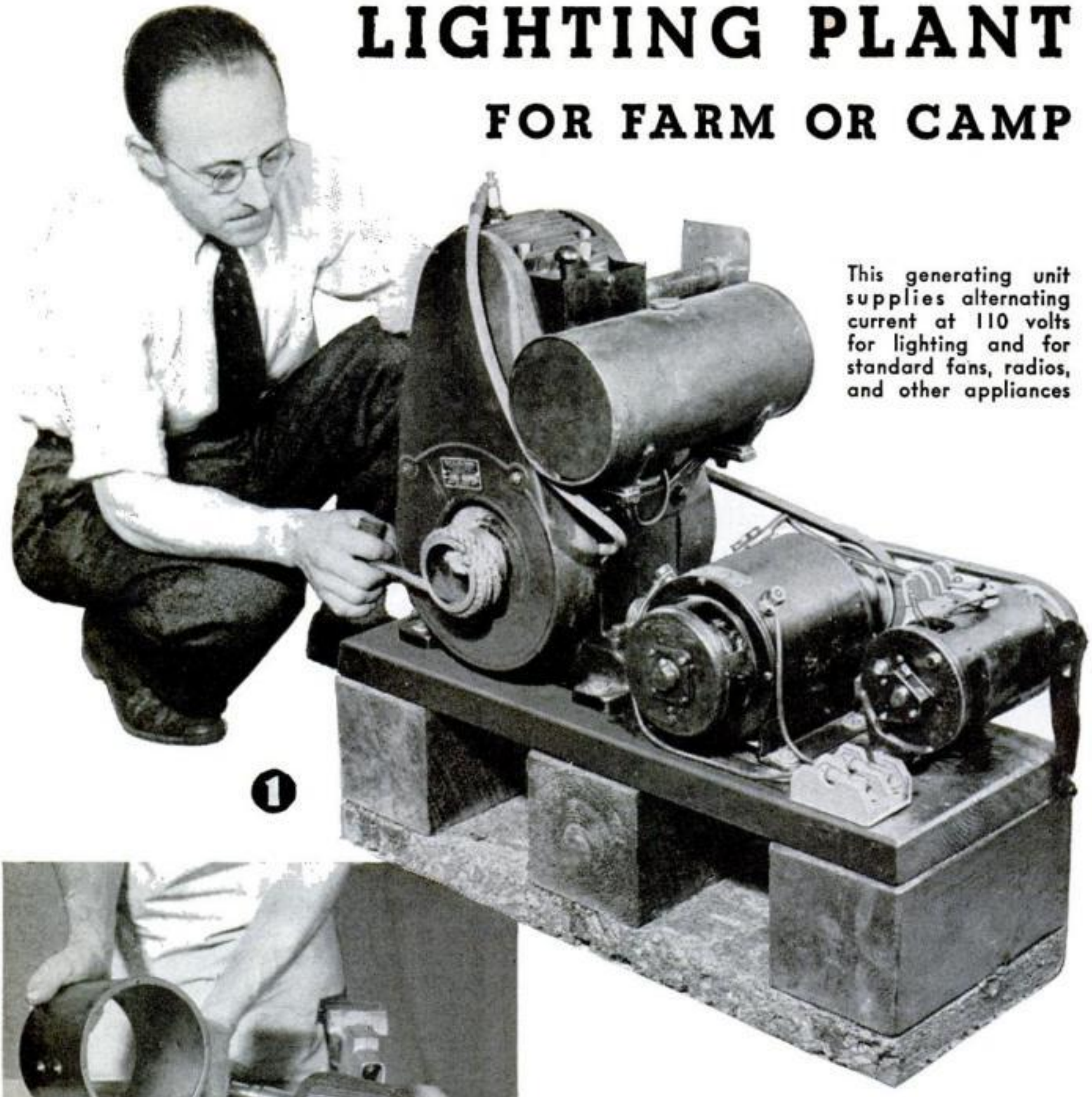
LIGHTING PLANT

FOR FARM OR CAMP



This generating unit supplies alternating current at 110 volts for lighting and for standard fans, radios, and other appliances

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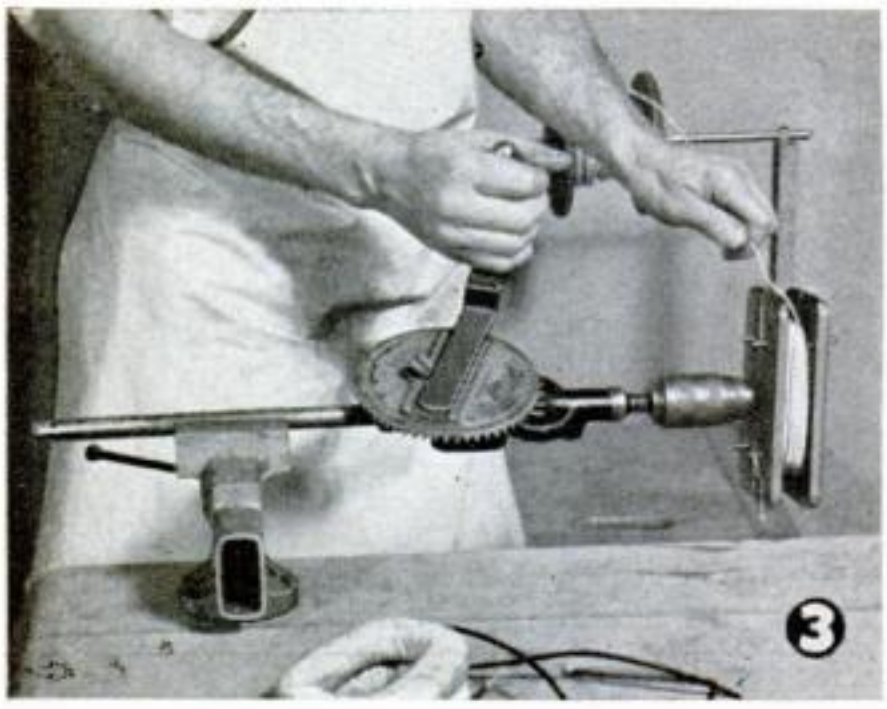
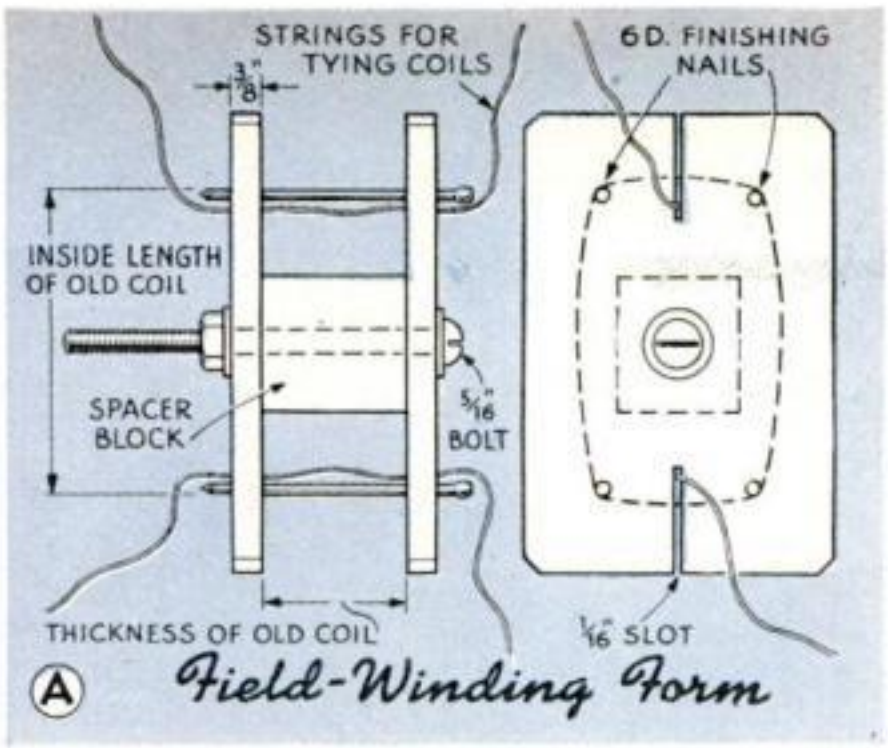


3

By HAROLD P. STRAND

TWO old automobile generators picked up in a junk yard for four dollars form the main generator and exciter of this lighting plant. It delivers 110-115 volts, 60 cycles, at 1,800 r.p.m., and is capable of carrying 800 watts load—all that is necessary to render excellent service on the farm or at a summer home or camp where power service is not available.

The advantages of generating the same kind of current as that supplied for ordinary house service are many, including the possibility of using standard lamps and appliances up to the capacity of the plant. In addition, it is easy to transform the voltage up or down to meet special requirements as desired. This is something that cannot be done with direct current.



A Field-Winding Form

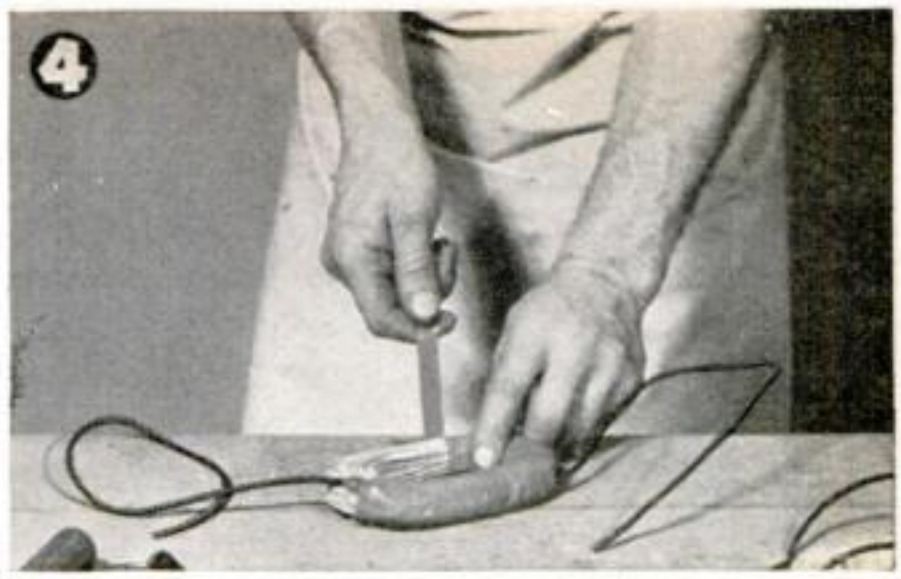
The larger of the two generators was one of the heavy 12-volt type, but any ordinary 6-volt generator will do for the exciter. The latter is used to supply D. C. voltage to the field coils of the main unit. The gas engine, rated at 2 h.p., was bought second-hand for twenty dollars and is air-cooled. The assembled unit is shown in Fig. 1, where the engine is about to be started for the first test.

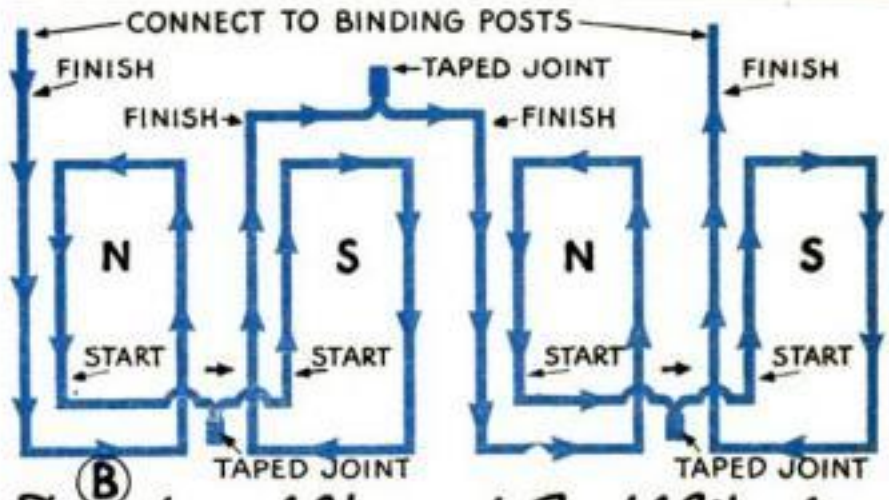
The base is solidly built to prevent vibration—a 12″ by 2″ hardwood plank secured to three 6″ by 6″ blocks. A sheet of refrigerator cork was used under the blocks to lessen the noise of operation during the test, but for a permanent job, the blocks can be secured to the floor by setting them in cement or any other convenient means. The exhaust should be piped to carry the fumes outside for safety.

The first step in constructing the plant is to dismantle the large generator completely and have two pieces of 2″ angle iron welded on at the sides, with two flat pieces for braces (Fig. 2). Two holes are drilled in each piece to clear ⅜″ bolts. It is a good idea, when taking off the pole pieces, to mark them so that they can later be replaced in exactly the same way.

The new field coils are wound on a special form, shown at *A* in the drawings. This can be put in the lathe, or in a breast drill held in the vise (Fig. 3). The taping is first removed from one of the old coils, and measurements are taken of the inside length and width. The placing of the nails in the sides of the form will be governed by these measurements. The length of the spacer block determines the thickness of the coil, which should be made the same as the old one. Put a piece of string in each slot and wind 200 turns of No. 17 single-cotton enamel wire (about a pound).

Tie the strings tightly around the coil and remove it from the form. Make four of these





B Developed View of Field Winding

ELECTROPLATING, PART 3 [ELECTRICAL]

The choice of a *tank* or container for the electrolyte depends largely on the quantity of the work and frequency of use. A small chinaware teacup, marked so that it will not be used for any other purpose, is satisfactory for electroplating finger rings and similar objects, while various sizes of stoneware crocks are suitable for larger work. Old storage battery cases with the individual cells removed, deep glass battery jars from a discarded farm-lighting plant, and all-glass aquarium tanks are excellent. When very large work must be handled, tanks can be built of wood, or old wooden tubs may be used if they are thoroughly cleaned, chemically as well as physically. Wood containers should rest on bricks to allow a free circulation of air underneath. The life of such tanks can be increased by lining them with a thick coating of hot asphalt, but this is not a protection against cyanide solutions. Many professional tanks are lined with heavy sheet lead, the seams being soldered with the same material. This is effective with most electrolytes, but less suited to those containing large amounts of acetates, citrates, and tartrates.

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coils exactly alike. For flexible leads, solder 6″ pieces of No. 16 flexible rubber-covered wire to the ends of the windings. Mark each inside end for later identification.

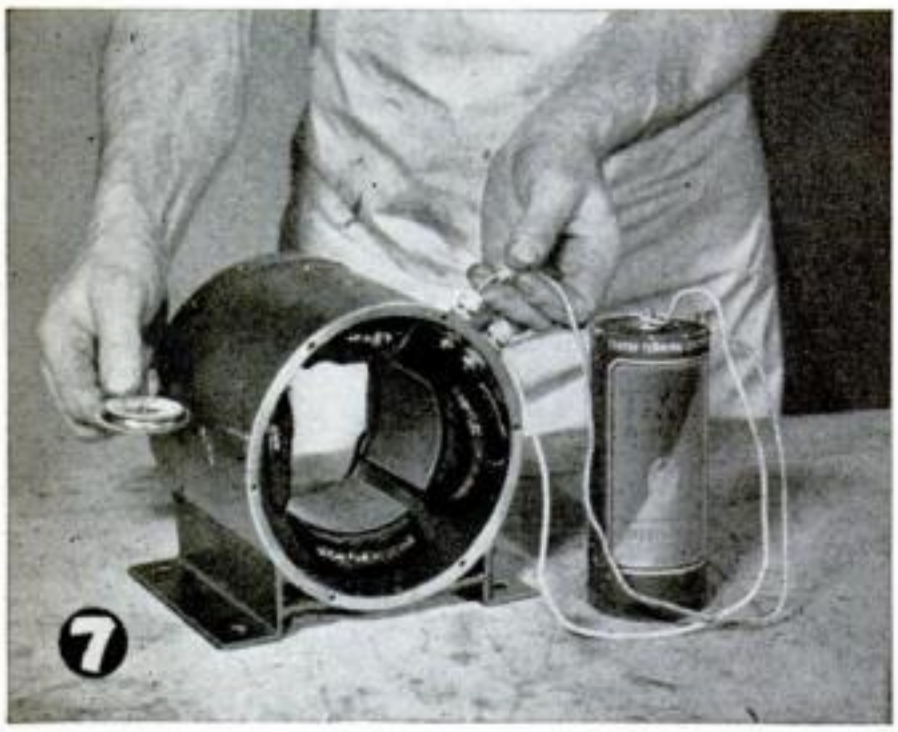
In Fig. 4 the taping is being done. The first layer is wound with strips of varnished cloth. Take care to wrap a small piece of the cloth around each joint and then bind it down tightly with the succeeding turn. Follow with a wrapping of cotton tape.

Next, insulate the coils thoroughly with a good insulating varnish (Fig. 5). They are allowed to drain for a short period, after which a baking in a moderately hot oven is recommended.

The placing of the new coils in the frame should be done with due respect for the polarity. In the drawing *B* the connections are shown, and it should be noted that a "finish" end of the first coil is left out for the terminal post. The coils are then connected, start to start, finish to finish, start to start, and the last finish end connects to the other post. This reverses the current for each pole as indicated.

In Fig. 6 the screws that secure the pole pieces are being drawn tight, the latter being replaced in their original positions. After the three joints have been made, solder and tape them. Two binding posts are then mounted on the frame with insulating washers, and the leads connected to them. Testing is done with a battery and compass as in Fig. 7. As the frame is turned over to bring each pole in turn near the compass, the opposite end of the needle should be attracted in each case in successive order. Also use a series test lamp to make sure no grounds exist to the frame.

The work on the armature is started by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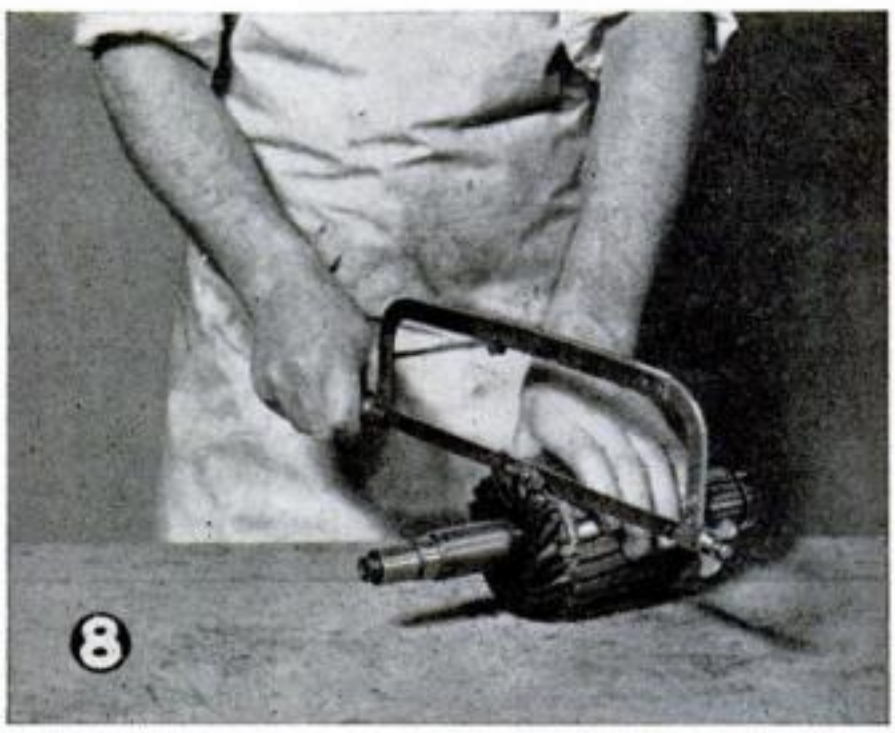

8

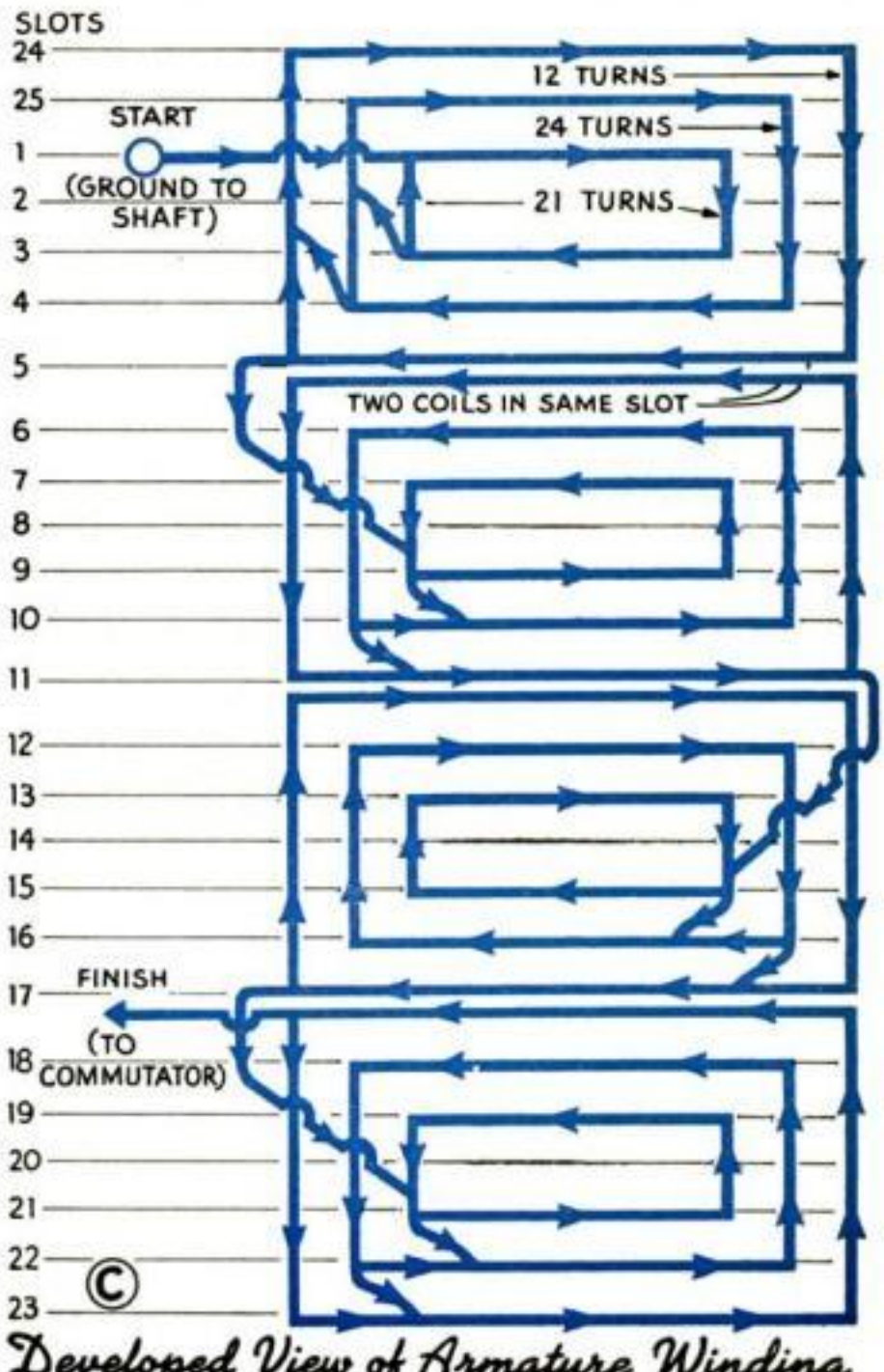
stripping off all the old wire and insulation. In Fig. 8 a hack saw is being used to cut off the old coils. The slot wedges can be punched out, and the wires unsoldered from the commutator. It is then an easy matter to pull out the wires and clean the armature down to the iron core.

The slots are reinsulated with some 0.010" armature paper cut in strips that will project over the ends of the slots about ¼" and about ⅛" above the top. These are laid in each slot and fitted against the round surface by using a round stick or pencil.

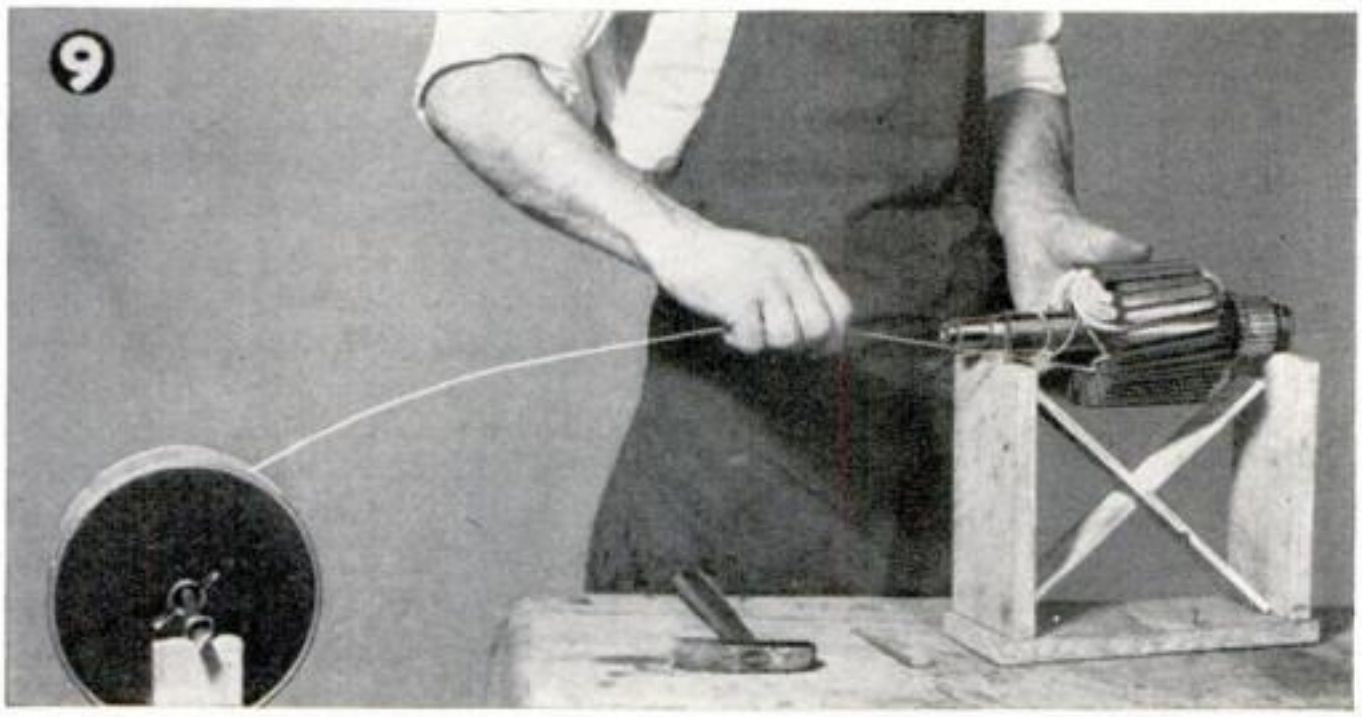
The general winding scheme is made clear in drawing *C* and Fig. 9. Use No. 15 S. C. E. (single-cotton enamel) wire and start with a turn around the shaft. The wire then enters slot 1, proceeds to slot 3, and continues for 21 turns. From there it is carried in the same direction to slots 25 and 4 to make 24 turns. Twelve turns are then put in slots 24 and 5, from which the wire is taken in a *reverse* direction to slot 9, and 21 turns are put in slots 9 and 7. This method is carried out for the entire job. Use one continuous wire, without joint or splice. Each coil in a group is wound in the same direction, but each group as a whole is wound in reverse fashion from the preceding and following one.

Connect the start of the winding to the shaft by drilling and tapping the latter for a 10-32 machine screw, as in Fig. 10. The finish end is soldered to a commutator riser, and a continuous band of solder is carried all around the tops of all risers to form one complete collector ring. Before attaching either end of the winding, it would be well to use a series test lamp to make sure the winding is not grounded to the core. Thin strips of fiber can then be placed in the slots to keep the wires in place. Follow with a good application of the insulating varnish, and bake as before.

The generator is next assembled, with one insulated brush only bearing against the collector. A No. 14 flexible lead is connected from this brush to the insulated binding post, which is one of the original heavy posts on top. See that the other heavy post is grounded, which means that no insulation at all is used under it, and all paint or grease is scraped off the frame at this point to insure a good contact. Figure 11 shows the two units being set up on the base, and the method of tightening the exciter belt. The exciter is pivoted upon its lower mounting lug, and adjusted by moving the other bolt up or down in the slotted bracket at the extreme left. Some holes are

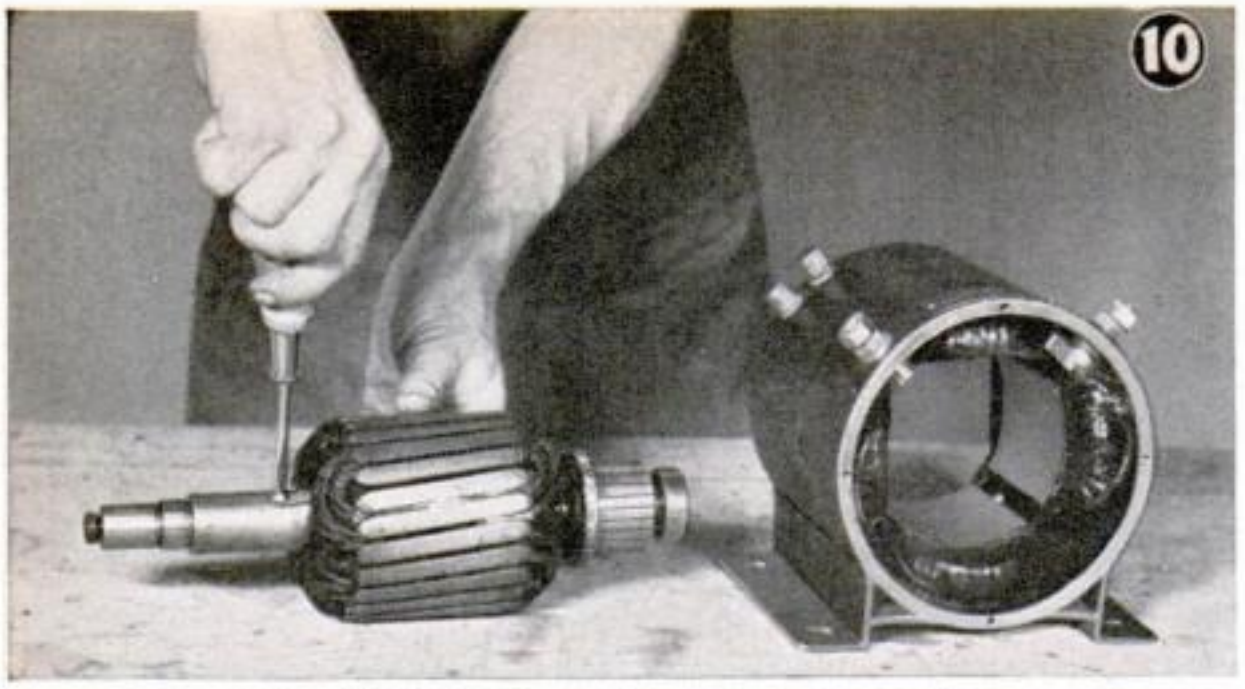


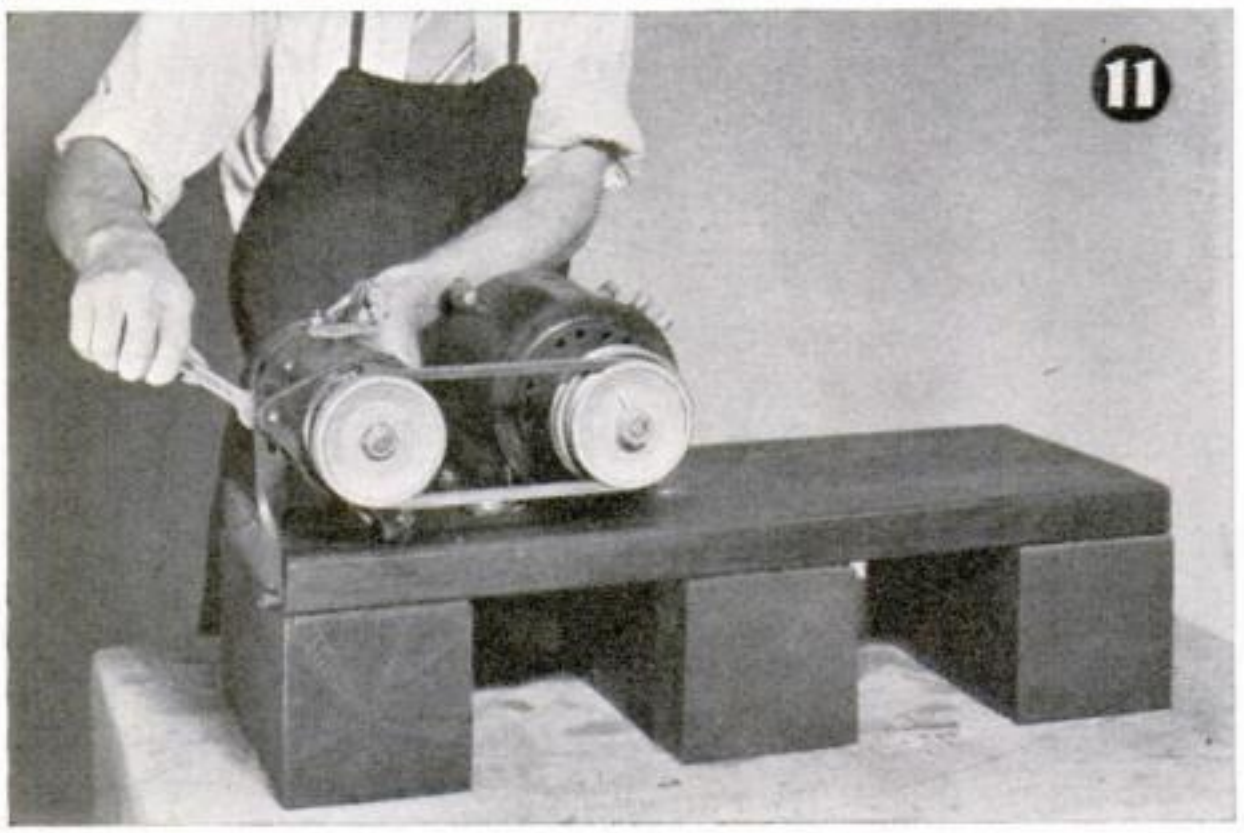
Developed View of Armature Winding

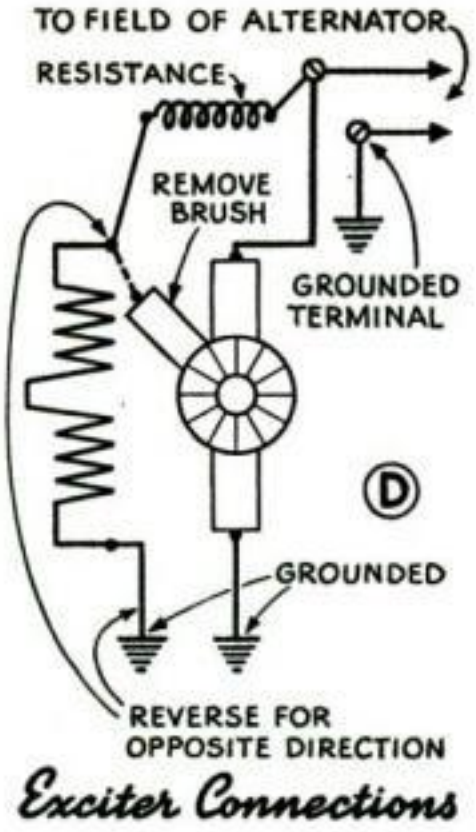


The armature winding is a continuous length. Wind evenly and tamp the wire in place to get in the required turns. Make all end loops alike to keep armature in balance

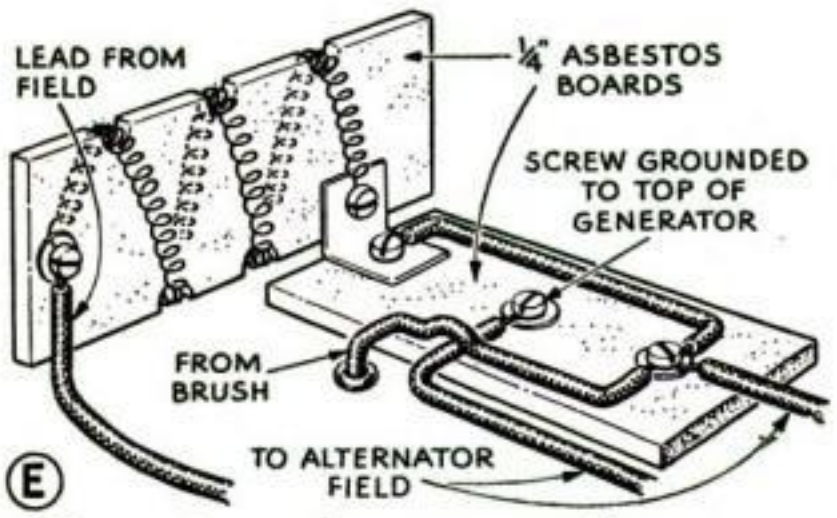
After winding armature as at left, test for grounds with a series lamp before making terminal connections







Exciter Connections



Details of Resistance Unit

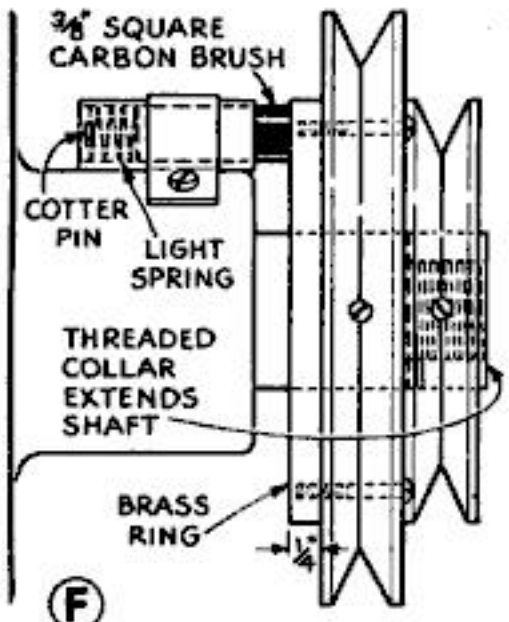
drilled in the bearing housings of the main generator before assembly to improve ventilation.

The exciter must be tested by driving it to learn its direction of generating. As you face the commutator, it should generate when running clockwise to be the same as the alternator. If it generates when going the other way, open it up and reverse the two field leads. Also, the third or regulating brush is removed.

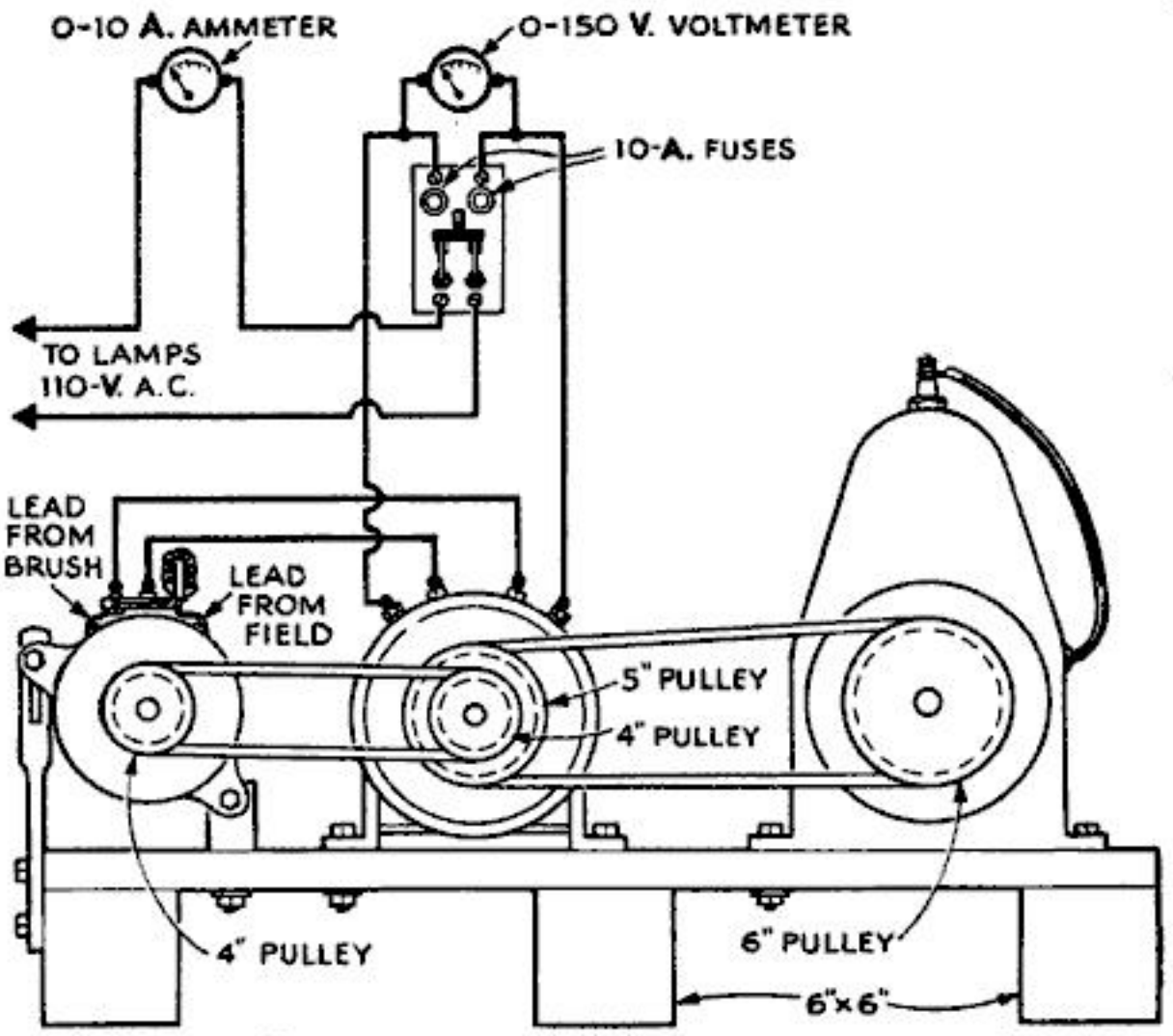
Drawing *D* shows the diagram of connections, and how the lead that normally connects to the third brush is carried up and connects to some resistance wire to limit the field current. The amount of this wire must be determined by experiment with an ammeter. Use some coiled No. 18 or 19 resistance wire (the usual heating element used in electric ranges). Drawing *E* illustrates the method of making a terminal block and form for the wire on top of the exciter. Sufficient resistance must be used to allow only about 3 amperes to flow in the exciter field circuit, which in the average case may take about 6″ of close-coiled wire if it is wound on a 3/16″ arbor.

To prevent the grounded side of the A. C. current from having to pass through the bearings, a special grounding brush should be made and attached to the end of the bearing housing as in drawing *F*. The method of extending the shaft to take the second pulley is also shown—a threaded collar made to screw on the threaded end of the shaft.

Drawing *G* shows the general arrangement of the units and the wiring plan. A speed counter should be used when first starting the plant to determine the best engine-speed settings. For 60 cycles the generator must be run close to 1,800 r.p.m. Once set, the engine governor should regulate it fairly uniformly. The voltage is then checked, and it should be around 115 volts, no load. If it is high or low, don't change the engine speed, but try varying the exciter speed with a larger or smaller pulley,



Ⓕ *Details of Grounding Brush and Pulleys*



Ⓖ *General Arrangement of Units and Wiring Connections*

as may be required. Another method is to vary the resistance in the exciter field circuit *(E)*, which in turn will affect the A. C. output.

In calculating pulley sizes required to drive the generator at the correct speed for 60-cycle current, the usual simple formula is used (see "Pulley Speeds and Sizes," P.S.M., Dec. '38, p. 195). The engine in this case has a 6" pulley and runs at 1,500 r.p.m. To find the speed at which an alternator must turn to generate 60-cycle current, multiply the number of cycles (60) by the number of seconds in a minute (60) and divide by the number of *pairs* of poles. Our four-pole generator, must therefore turn at 1,800 r.p.m.

To find the size of the generator pulley, multiply that of the engine pulley (6") by its speed (1,500) and divide the product by the required generator speed (1,800), which will give 5" as the required pulley size.

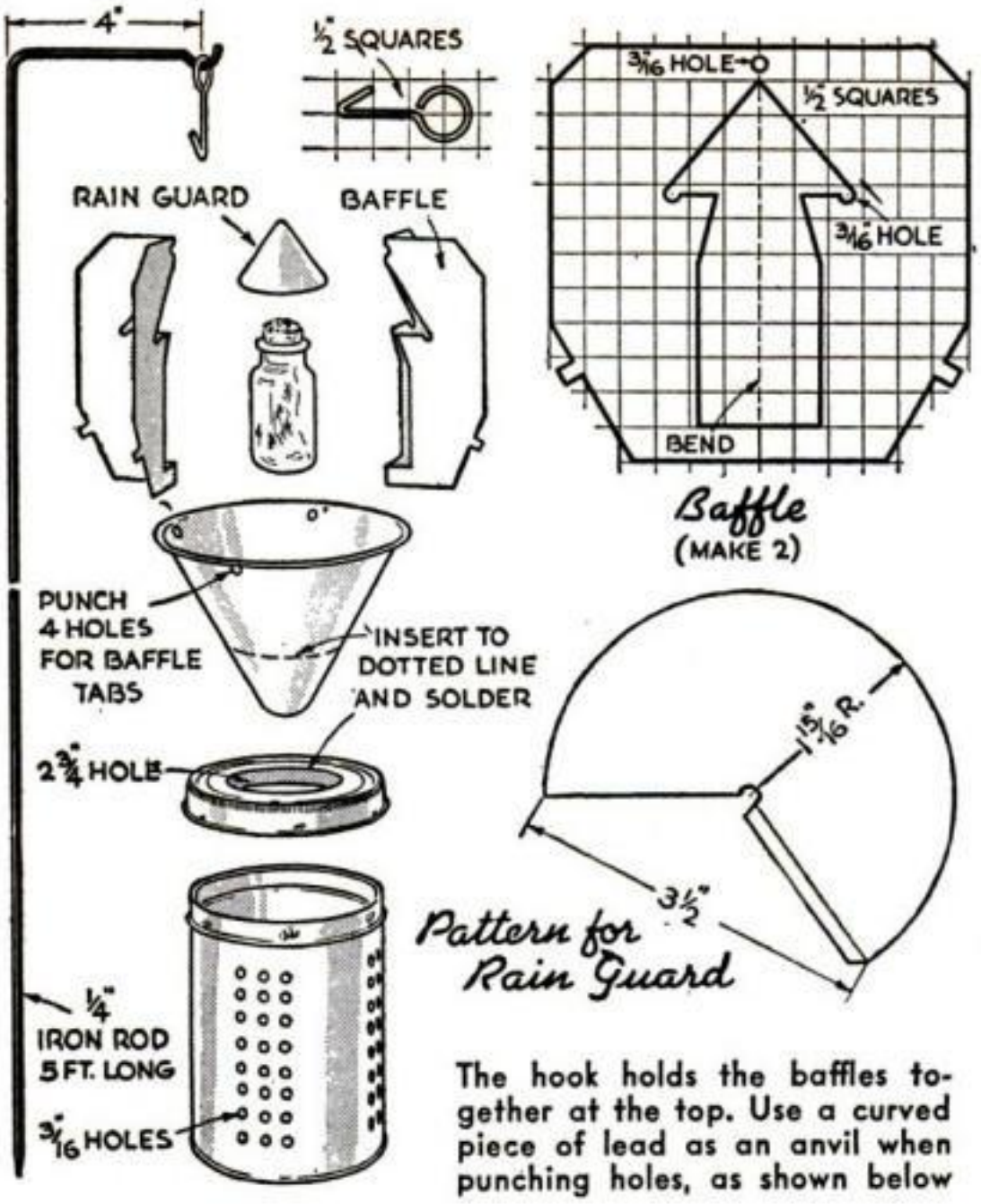
RUBBER-STAMP NEGATIVES [*METAL ETCHING—7*]

In some cases it is desired to etch metal with a rubber stamp in such a way that the background is etched, but the trade-mark, letters, or numbers remain untouched, in bright metal. This is the negative or reverse process.

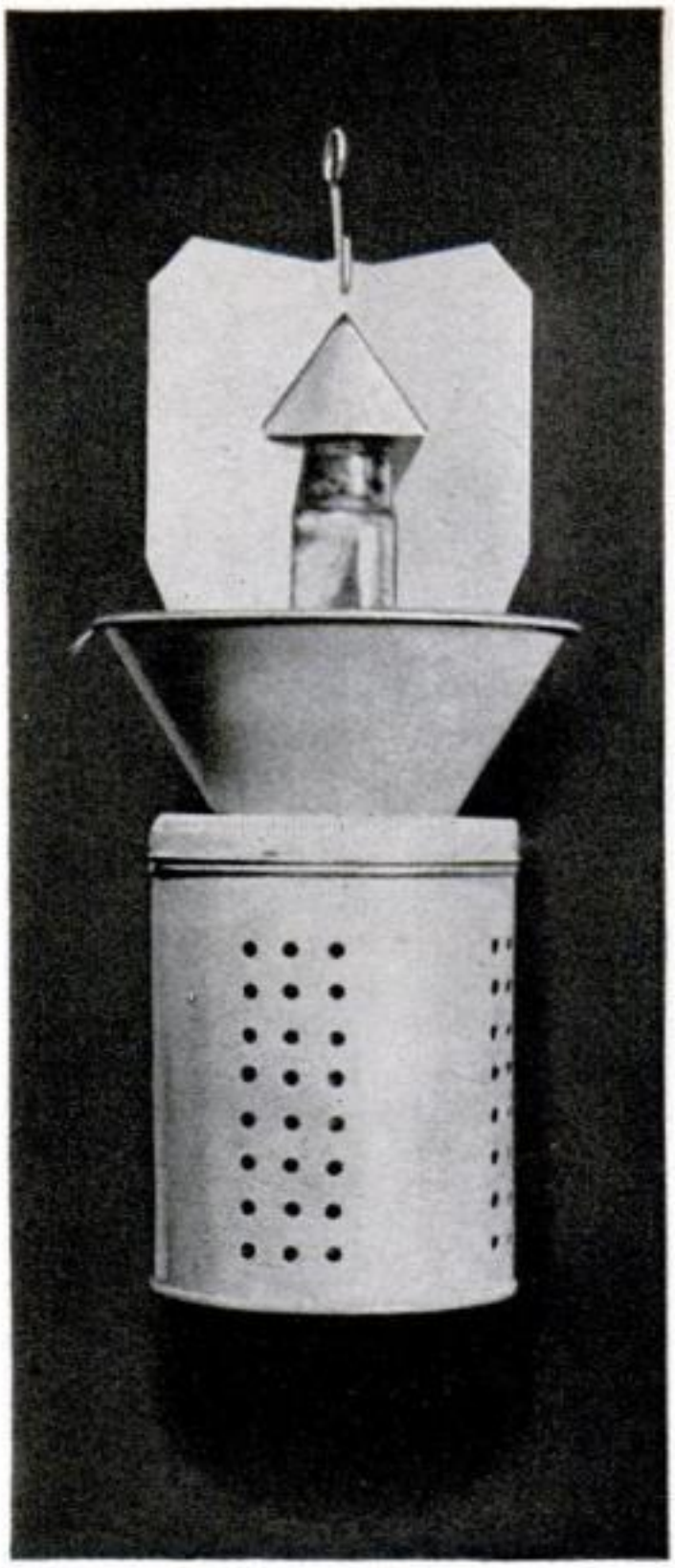
Clean the metal thoroughly with dry abrasive. Use a camel's-hair brush to paint asphaltum varnish very thinly over the surface of a piece of glass. Press the rubber stamp upon the glass so as to coat the letters evenly with asphaltum. Now press the stamp down gently on the metal. Remove it carefully so as not to smear the impression. Let dry hard before applying the etching solution. Clean the stamp thoroughly with kerosene or thin oil and wipe it dry after each impression is made.

Build a putty or wax fence around the section to be etched. With a cotton swab, apply a few drops of the etching solution and let it remain until the metal is etched to the desired depth. For steel, use equal parts of muriatic acid and commercial nitric acid. After the asphaltum has been removed with kerosene or lacquer thinner, polish and apply oil to prevent rust. For copper or brass, use water to which an equal amount of nitric acid has been added, or, for a quick job, use full-strength commercial nitric acid.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



The hook holds the baffles together at the top. Use a curved piece of lead as an anvil when punching holes, as shown below



Beetle Traps from Old Tin Cans

THE depredations committed by Japanese beetles have forcibly brought home to thousands of gardeners the menace which these winged pests present (see P.S.M., April '41, p. 108). For combating them, a strong offensive is the best defense, and the home owner who builds and sets up several of these traps will have gone far toward protecting his plants and lawn. Each trap will attract and catch beetles within an area of several hundred square feet.

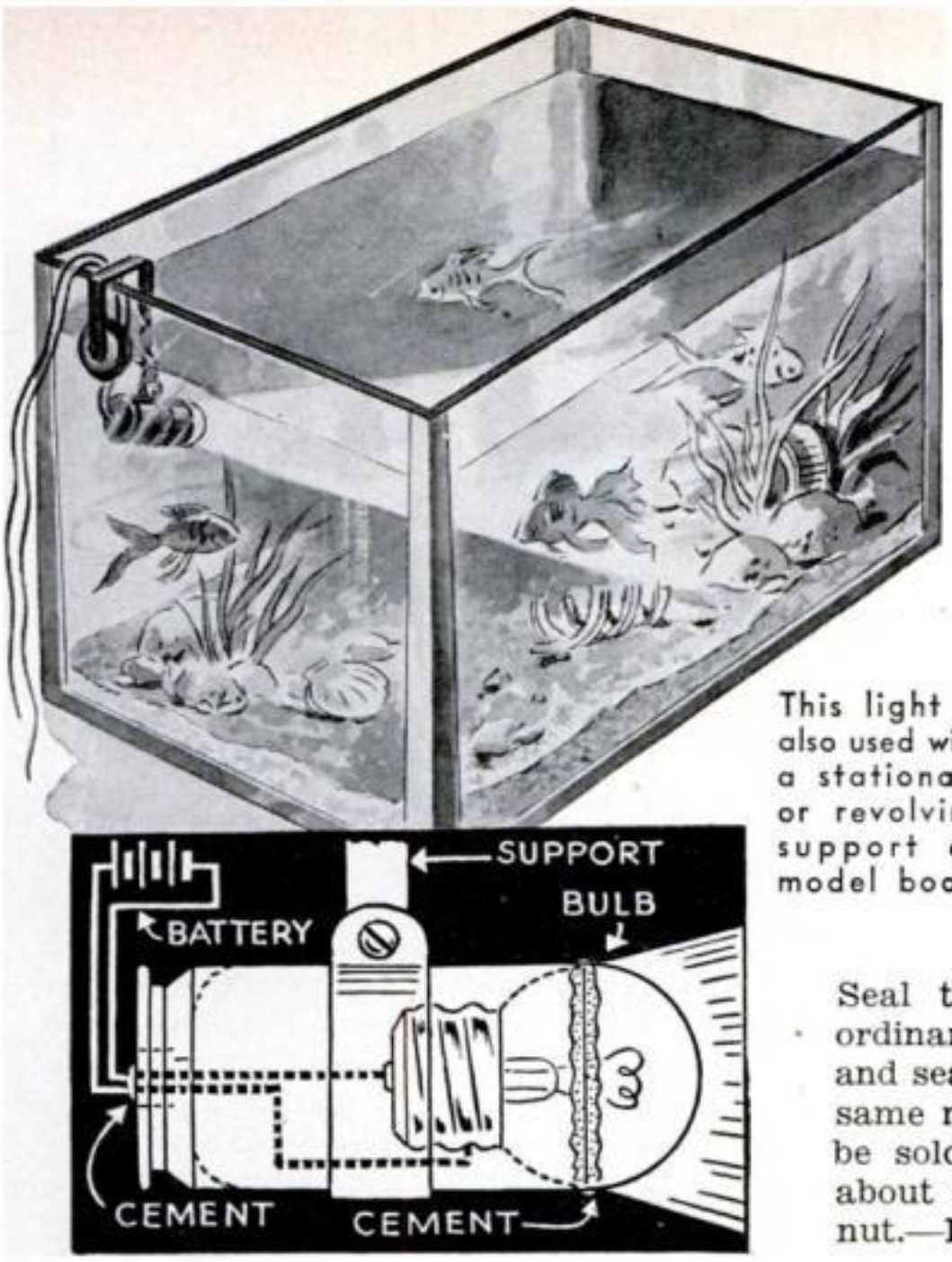
The body of the trap is a 1-lb. coffee can having a bayonet-lock top. Punch or drill four groups of 3/16" holes in the side, and twelve similar holes in the bottom. Cut a 2¾" hole in the lid. Into this solder a 5½" tin funnel from which the spout has been removed. Punch four equally spaced ¼" holes close to the rolled edge of the funnel to receive the baffle tabs.

After cutting the two baffles from scrap tin, which may be obtained from tin cans, bend each at a right angle along its center line. Cut out the pattern for the rain guard and solder it along the seam to form a cone 2⅝" across at its base. Bend the small hook to shape from stiff wire.

The bait bottle is a 1-oz. bottle of the round, wide-mouth type. Make a ½" hole in its cork and insert two folded kerosene-lamp wicks, allowing them to project about ¼". A 1-oz. bottle of geraniol, the bait used, can be bought at any garden supply store and should last the entire season.

Paint all parts of the trap a bright yellow. When dry, assemble as shown and hang in a sunny spot not too near shrubs or trees. Empty occasionally, burning the trapped beetles.—E. B. HAFFNER.

Miniature Underwater Light for Marine Model Work Made from Cartridge Shell

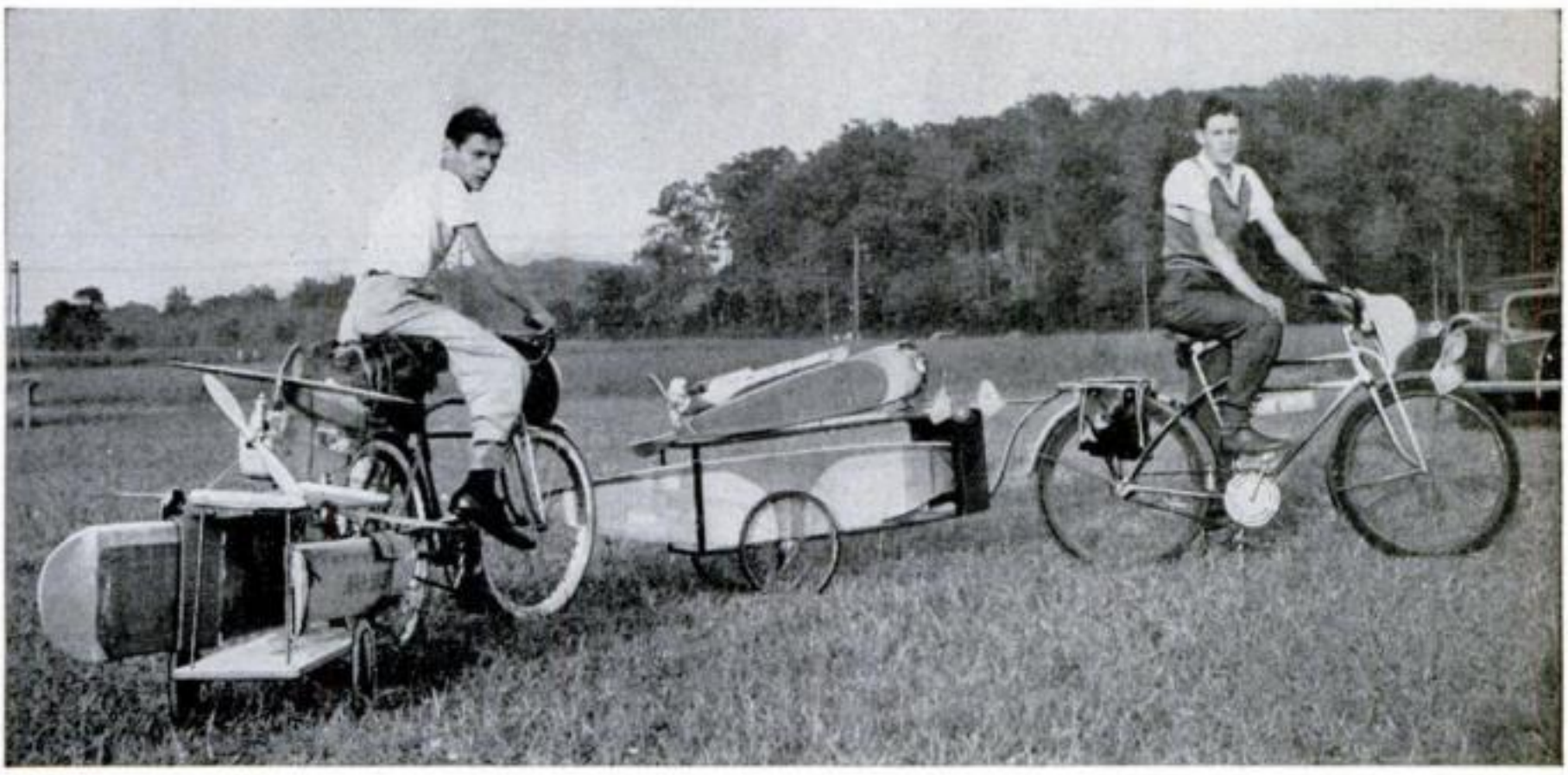


This light is also used with a stationary or revolving support on model boats

A REALISTIC little flood or spotlight for use under water, which is suitable for many types of marine model displays as well as tropical fish aquariums and the like, can be made in a few minutes from an empty .45 caliber cartridge case. Do not use an unfired cartridge. Punch or drill a hole where the detonating cap was. Draw two insulated wires through at this point and solder them to the bulb, which is inserted in place of the bullet. Use an ordinary flash-light bulb for a flood effect, or the type with a heavy glass bead at the tip, as sold for certain small pocket flash lights, to obtain a spotlight beam. Seal the bulb into the cartridge case with ordinary cellulose (model-airplane) cement, and seal the wires where they emerge with the same material. The support should previously be soldered to the shell, or may be clamped about it and held in place with a screw and nut.—L. W. EINBINDER.

Model Gas Planes Carried to Airfield on Bicycle Trailers

THE bicycle trailers illustrated are used for carrying large gas-powered model airplanes to and from the flying field. Each trailer frame is made of light angle iron and fitted with a plywood bottom. An axle is bolted across the bottom for attaching a pair of small wagon or baby-carriage wheels. An upper deck or shelf may be added. Models are held on with cord and rubber padding.—BENNIE W. MAYCHECK.



Couplings are of strap iron, bolted fast to the trailers but pivoted where attached to the bicycles

HOME CHEMISTRY FORMULAS for Household Emergencies

SO YOU'RE a chemical magician? You change water into fake wine, conjure up foul-smelling chemical snakes that slither across the kitchen table, eat fire like a demon! But when mother or wife comes to you pleadingly with a nice new shirt splotched with ink, and asks if you can make the spot disappear, you hocus-pocus yourself out the back door! When father breaks a china knickknack and steals into your laboratory with the hope that by concocting something from your rows of impressive bottles you can restore the treasure to wholeness, you promptly refer him to the nearest hardware store!

Every home chemical wizard worthy of the name should be able to pull out tricks from his formula books and chemical shelves capable of working magic in not only these but in dozens of other everyday household emergencies. With only a few hours' study and experimentation, he can learn to speed dirt and stains from fabrics, make pastes and cements, remove rust, chase vermin, conjure up baking powder in a jiffy, repair porcelain finishes and broken plaster—stunts that not only amaze strangers but help justify his existence to his immediate family.

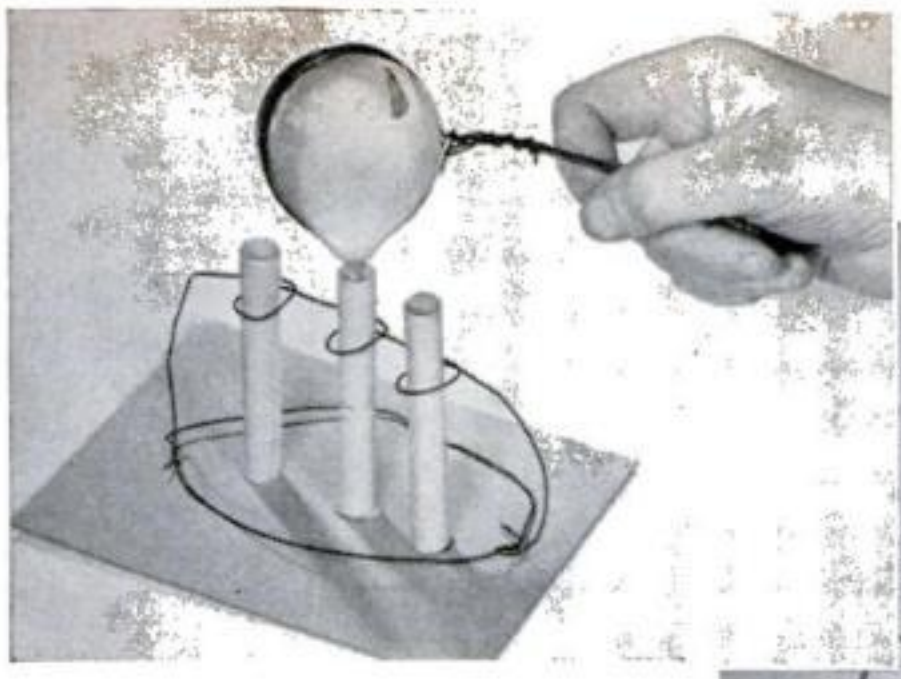
Here are a few formulas for a good start. We begin with the ink spot. Mix together equal parts of potassium bitartrate ("cream of tartar") and citric acid. Heat a dinner plate and lay the stained part, wet with hot water, in it. Rub the powder on the spot until it disappears, and then rinse in clean water. Most inks will respond.

Another ink remover, which in addition removes many other stains, such as rust, fruit juice, wine, and so on, and which may be used also as an ink eradicator on paper, may be made from two common chemicals found in almost every kitchen. Two solutions are prepared. For the first, dissolve 1 part of calcium hypochlorite (bleaching powder, or "chloride of lime") in 12 parts water. For the second, 2 parts of crystallized sodium carbonate (sal soda or washing soda) are dissolved in 4 parts water. Add the second solution to the first, let stand and settle. Siphon off the solution, filter, and store in well-corked brown bottles. Before using this on colored fabrics, it is best to test a small sample first for the reaction of the dye.

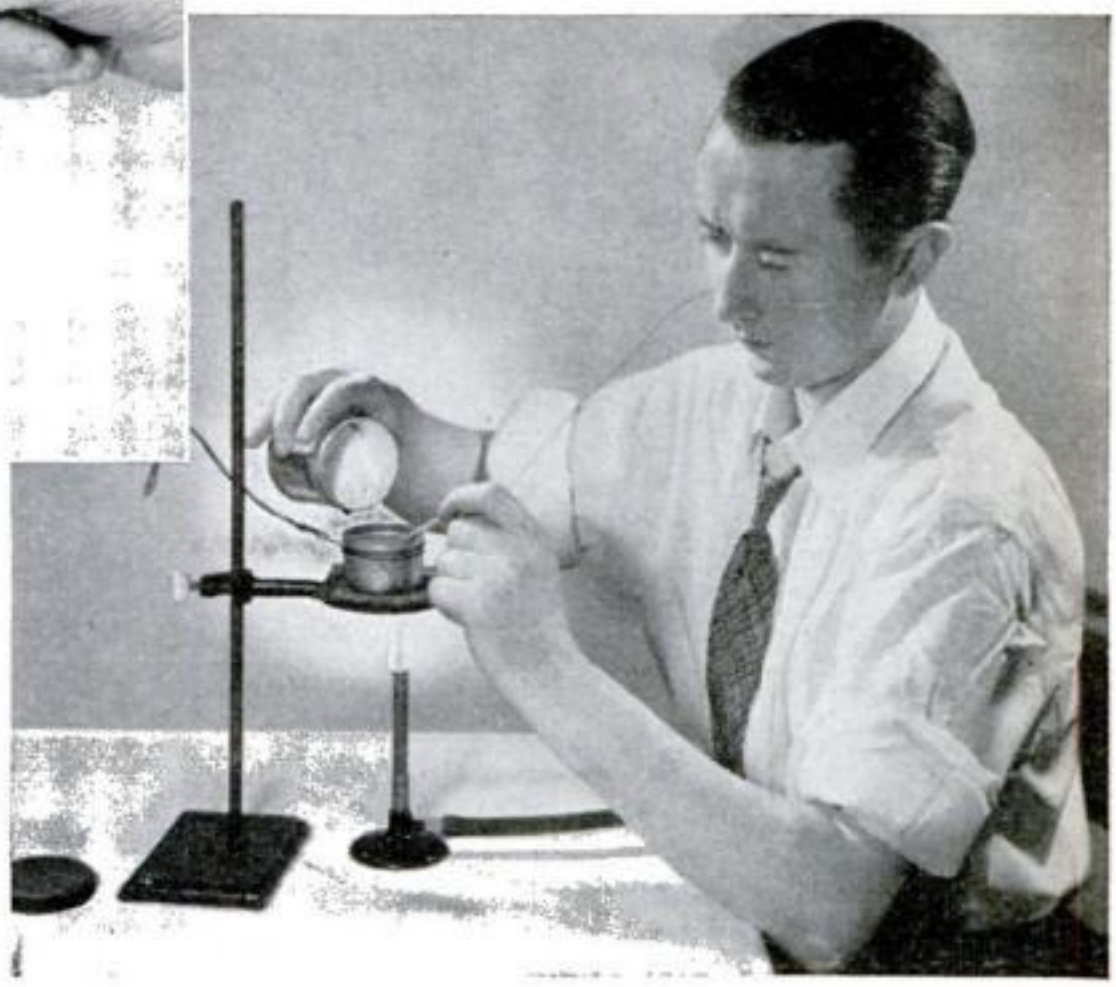
Tin (stannic) chloride occurs in many formulas as a solvent of iron rust. For iron rust on fabrics, mix ½ part tin chloride, 1 part potassium bitartrate, and 1 part oxalic acid. Mix with a little water and apply to the dampened spot. Iron rust may be removed from metal with a saturated solution of tin chloride, the length of time required depending upon thickness of rust. Rinse the metal well with water after treatment.

Sodium thiosulphate, or ordinary photographers' "hypo," can be made to do several practical "magic" stunts in the household. Rub your tarnished silverware with a little of it dissolved in water, and the tarnish disappears miraculously. Pour a

INK ERADICATOR. A good one-solution ink remover is prepared from ordinary chloride of lime, or bleaching powder, and sodium carbonate. The same solution is useful for removing rust, fruit juice, and many other stains from fabrics



STICK CEMENT for repairing porcelain finishes is easy to make in the home laboratory. Add titanium oxide to melted white shellac and cast in paper molds as at left



solution of hypo through a fabric stained with iodine, and the stain vanishes almost in a flash. So positive and rapid is the reaction of hypo on iodine that these two chemicals are used in one form of the wine-changed-to-water trick.

The stain of scorching may usually be removed by treating the spot with a solution of potassium permanganate, followed with hydrogen peroxide. Stubborn stains caused by aniline dyes may be removed with this solution: sodium nitrate, 7 grains; dilute sulphuric acid, 15 drops; water, 1 ounce. Allow to stand a day or two before using, and apply with a sponge. As with all stain removers, material should be rinsed well after the spot has gone.

For all-around cleaning purposes, trisodium phosphate is a chemical wonder. In large quantities it costs only about five cents a pound. But even at the retail price of about 15 cents for a single pound it is still an investment in cleaning efficiency and economy. Dishes, clothes, hands, walls, woodwork, and even automobile-engine parts may all be cleaned with it. Merely dissolve it in water. For clothes, put 1 or 2 teaspoonfuls in a tub of water and let the clothes stand overnight. One ounce in a pailful of water cleans woodwork. One teaspoonful in the dishpan makes dishes sparkle. If 4 ounces are dissolved in a gallon of water, the solution may be used for the hands, like liquid soap.

No better insecticide for roaches is known than the sodium fluoride you use in glass-etching experiments. It is poison to humans and domestic animals, but if carefully applied it should not be dangerous. It is recommended by the Government and is used by most professional exterminators. In use, it is

BROKEN CHINA can be mended with a cement made from calcium carbonate, or precipitated chalk, mixed into a paste with a sodium silicate solution. Paint broken surfaces, press together, and wipe off the excess with a damp cloth

STICKUM. Sugar, starch, and gum arabic make an excellent paste for use on envelope flaps, labels, and gummed-paper tape

dusted along all tracks that the roaches frequent. Roaches do not eat it intentionally, but, like cats, they lick their feet, and are so poisoned. One thorough dusting of sodium fluoride should rid almost any house of these pests within 24 hours.

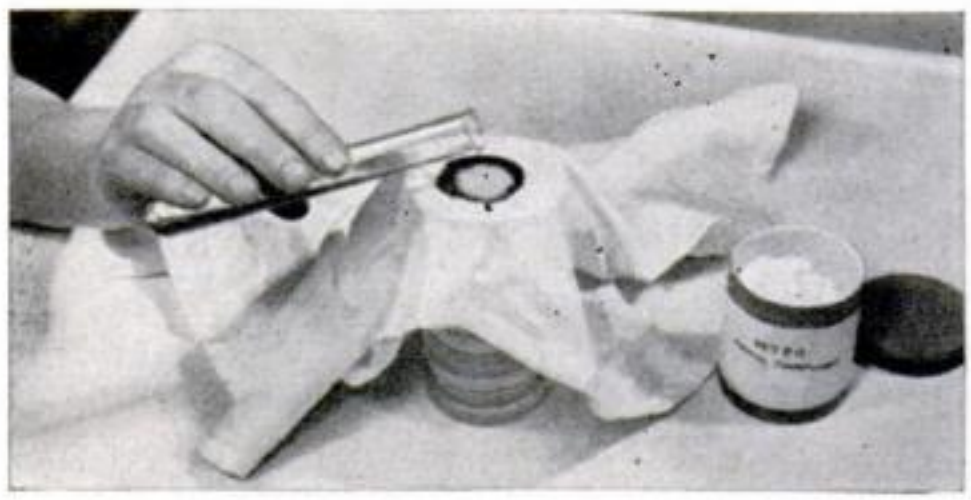
Did you ever need a gum for labels, envelope flaps that wouldn't stick, homemade paper tape? Next time try this: gum arabic, 1 part; starch, 1 part; sugar, 4 parts, mixed with enough water for desired consistency. First dissolve the gum arabic in some water, add sugar, and then starch. Boil a few minutes to dissolve starch, and then thin down.

Mix some calcium carbonate (precipitated chalk) with a solution of sodium silicate, into a thick paste, and you have a quickly made cement for broken china. Paint the broken surfaces with the cement, and squeeze together, removing excess that is pressed out with a damp cloth. Leave set for a day or two. This cement will not withstand water. Another china cement which sets quickly and will withstand heat, consists of manganese dioxide, 8 parts; zinc oxide, 10 parts; sodium silicate, 2 parts.

To patch plaster, mix together plaster of Paris, 8 parts; dextrin, 1 part; and pumice powder, 1 part. Shake these together in a dry can for several minutes, and mix with water as needed.

Porcelain finishes on bathtubs, sinks, tables, and so on, that have become chipped, may be repaired with patching sticks that may be compounded in your laboratory. Melt some white shellac over a low flame and add titanium oxide until a uniform white mixture is obtained. Pour into molds made of paper rolled into tubes about the size of cigarettes. When the mixture is cold, the paper should be removed. To repair a chip on porcelain, clean the spot and warm it enough to melt the mixture, now in rod form, when touched to it. Level off and smooth with fine sandpaper, and finally coat with porcelain enamel.

Waterproof glue makes a useful aid to the handy man about the house. It is easily prepared from four parts of ordinary glue (dry glue chips), one part of potassium bichromate (which also goes by the name of potassium dichromate), and some water. Exposure to light has the rather surprising effect of making this adhesive insoluble, and therefore unaffected by water. Since the preparation will not keep for more than two days before use, only enough should be made for immediate needs.



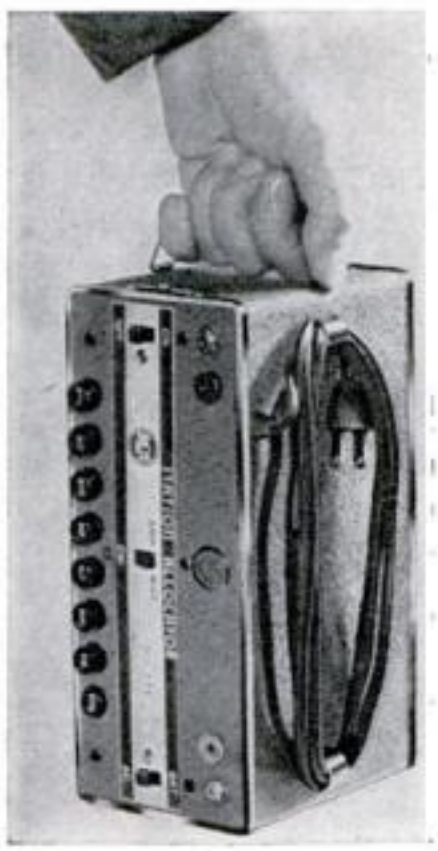
IODINE STAINS disappear like magic when a solution of photographers' "hypo" is poured through the fabric

SILVER POLISH. Tarnish on silverware also yields promptly to a rubbing with a solution of hypo in water

Radio Ideas

A suction cup holds the loop antenna against a window when the portable radio is used in a car

STRAP ANTENNA. A brown, flexible strap ending in a wide loop forms the unusual antenna of a new portable radio which can be operated in a train, automobile, or airplane. The looped end of the antenna is attached to a window by means of a suction cup. The other end is plugged into the top of the set. This Tom Thumb receiver is equipped with five tubes including the rectifier.



PUSH-BUTTON TESTER. Weighing only five and a half pounds, a portable tester for resetting push-button radio sets is equipped with eight controls which can be regulated to the wave lengths of stations within any given locality. The tester produces a signal that serves as a tuning guide.

A NEW TELESCOPE AERIAL, attached to a portable set by means of two metal clips, can be detached or slipped into place in an instant. Connections inside the cabinet are made to one of the clips. Extended, the five-sectioned antenna is 50 inches long; telescoped in, 14.

Applying flock finish to a phonograph turntable with the new kit

FLOCK-FINISH KIT. Radio cabinets, phonograph turntables, tool boxes, and other metal surfaces can be given the popular flock, or soft felt, finish in several colors by means of a new home kit. No experience and no expensive spraying equipment is necessary. The kit consists of a brush, a can of flock, a flock undercoat, and an undercoat thinner. The flock can has a special sifter top.

TWO-TUBE PORTABLE

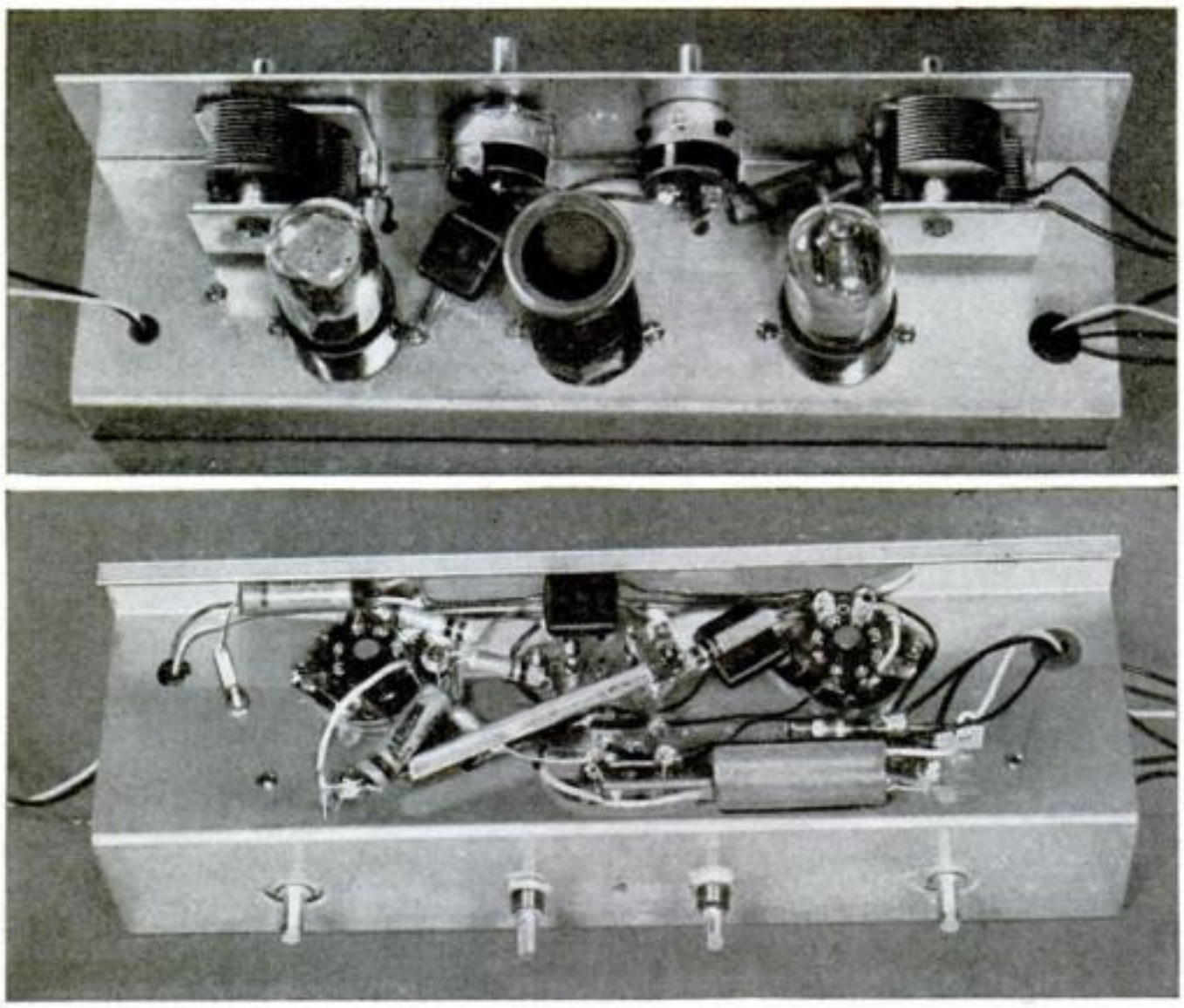
A COMPANION FOR LAST MONTH'S SUITCASE PHONOGRAPH

As a receiver, the set brings in local stations with good volume

DESIGNED as a companion piece to the suitcase phonograph described last month, (P.S.M., June '41, p. 202), this battery-operated portable will provide many hours of radio entertainment in your home, at parties, or on summer trips and picnics. Though it has only two tubes, it has sufficient power to bring in all local stations. When used with the phonograph, which it matches in size and appearance, it will give you your choice of recorded music or broadcast programs anywhere and at any time.

The suitcase in which the set is built can be purchased at almost any five-and-ten-cent store for 50 or 60 cents, and should measure 12″ by 9″ by 4½″. If you made the suitcase phonograph, you will probably wish to get a second suitcase with a similar exterior finish.

The two-tube chassis of the set, the four-inch speaker, and the batteries are fitted in the lower half of the suitcase, while the 9½″ loop antenna is placed inside the lid and fastened with two ½″-long 6/32″ machine screws.



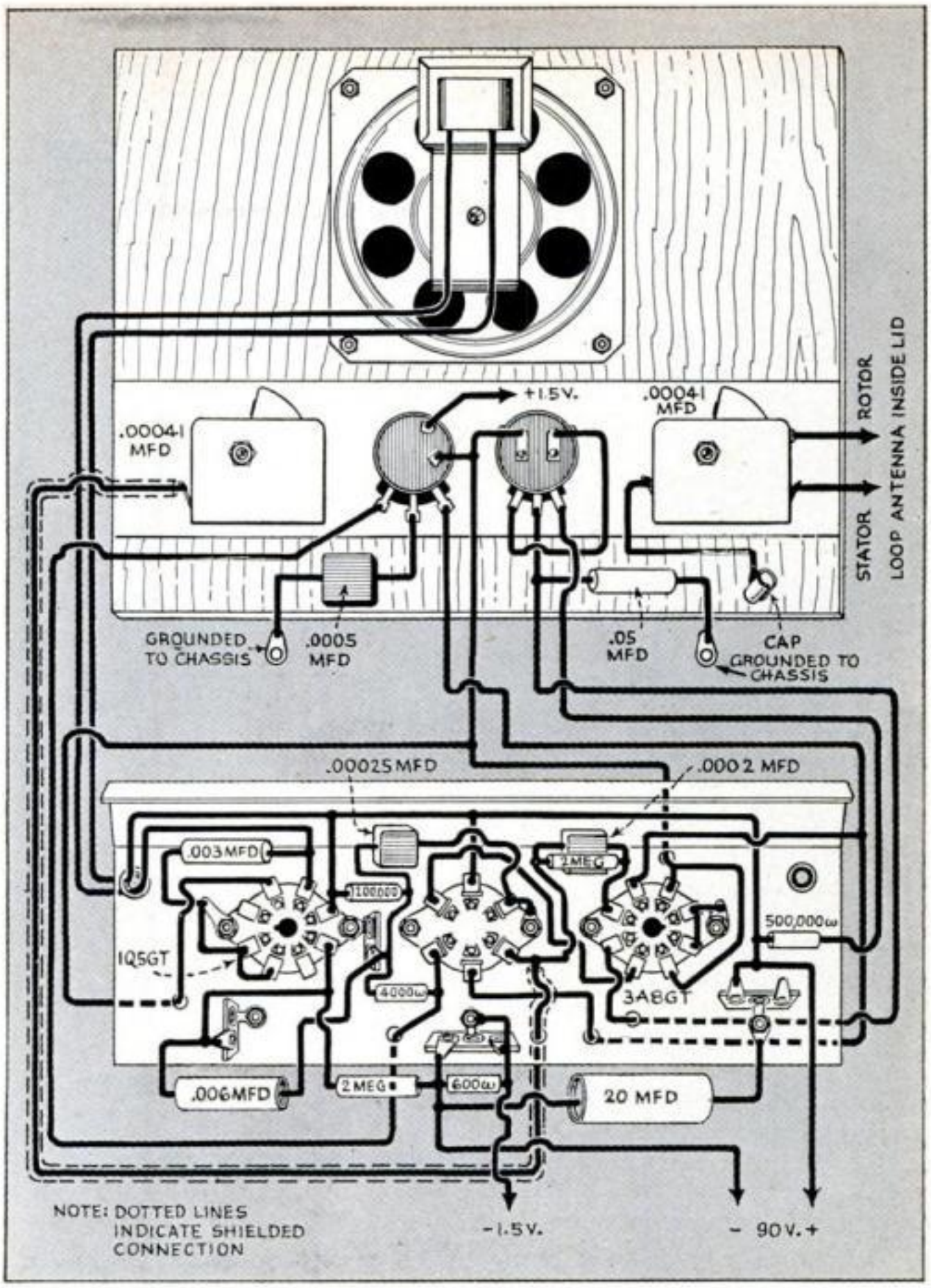
The upper picture at the left shows top view of the chassis with tubes and controls in place. Separate tuning condensers were found to be better than a ganged condenser. Lower photo shows the arrangement of parts underneath the chassis

Connections to the loop are made with two Fahnestock clips mounted on the lower inside edge of the lid. To hide the loop antenna, the author covered it with a 10" by 8" sheet of stiff paper.

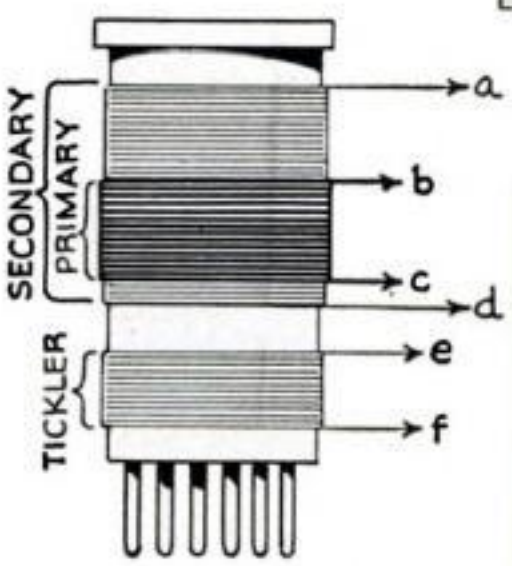
The metal chassis and speaker are mounted on a wooden panel measuring ¼" by 8½" by 11¼". The panel has a 3¾" diameter hole drilled near the top for the speaker, which is decorated with a bronze escutcheon plate.

The set uses a three-tube tuned-radio-frequency circuit, built around the two tubes —a 3A8GT (diode-triode-pentode) and a 1Q5GT (beam-power output tube). The 3A8GT is used for the tuned radio-frequency stage and the regenerative detector. The diode portion of the tube is not used and is wired directly to the chassis.

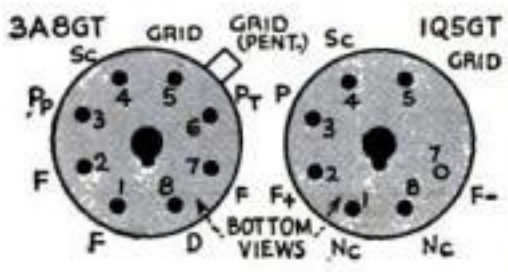
Separate tuning condensers were found to be better than a ganged condenser, as



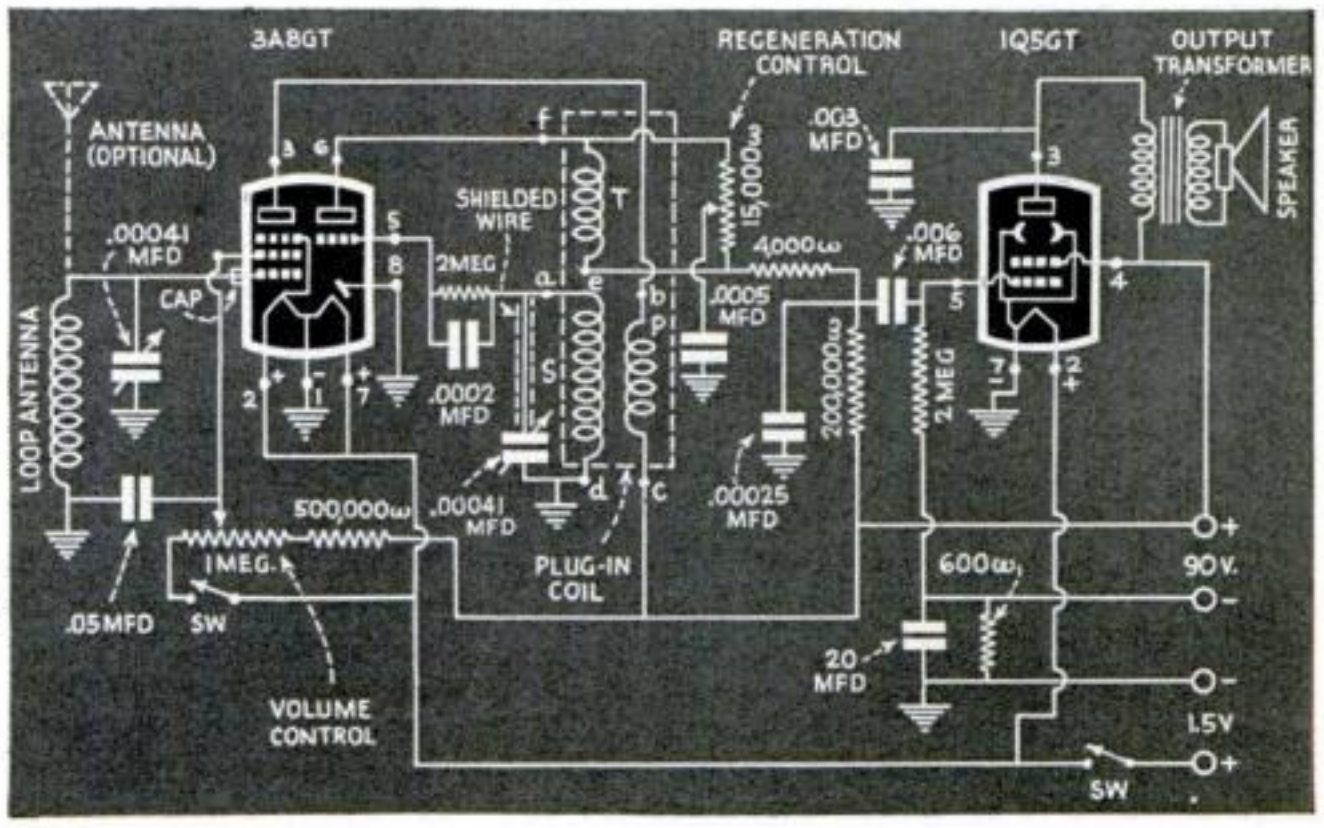
Complete wiring details for the circuit are given in this picture diagram

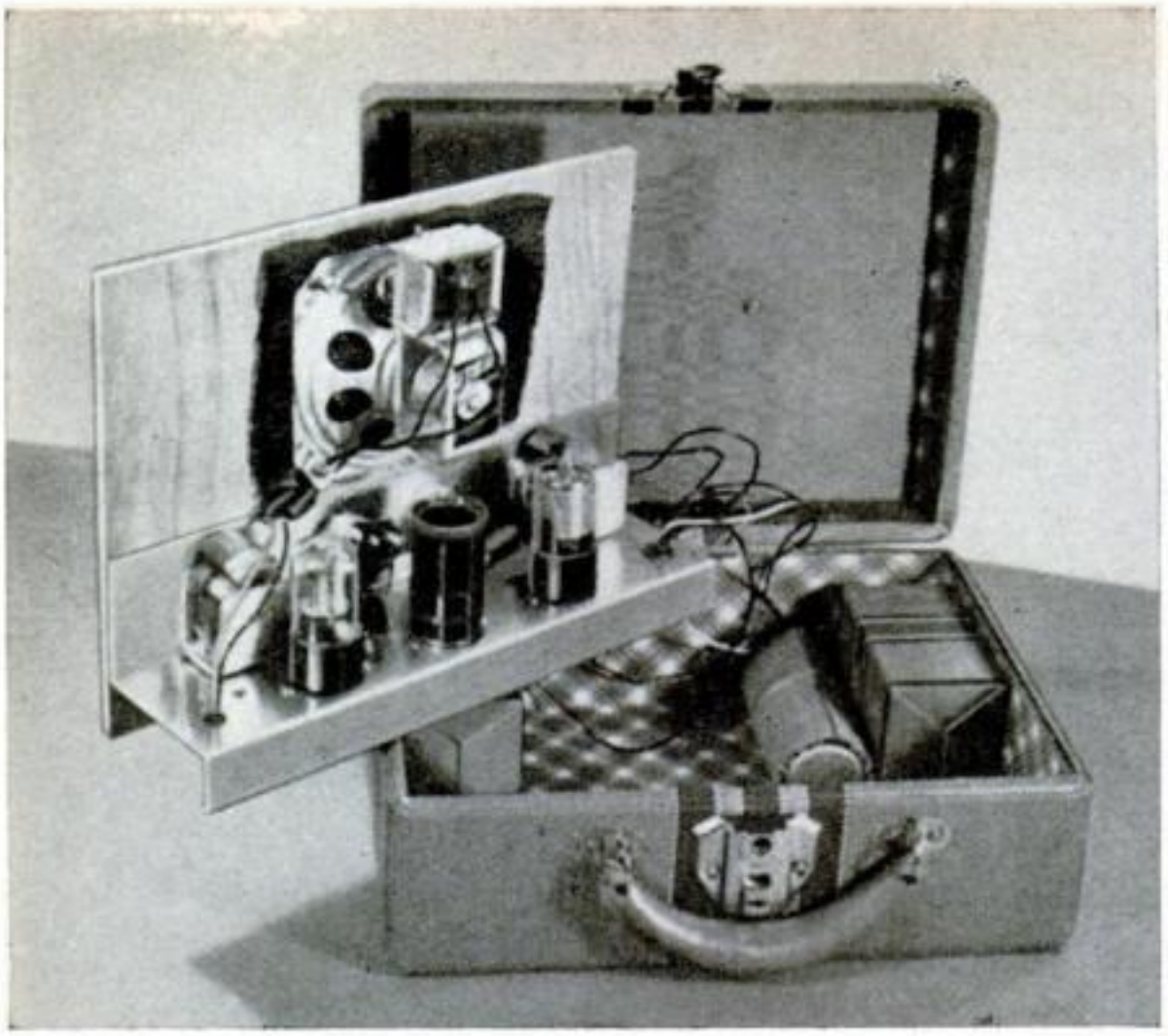


How the six-prong plug-in coil is wound. Below are tube-socket connections

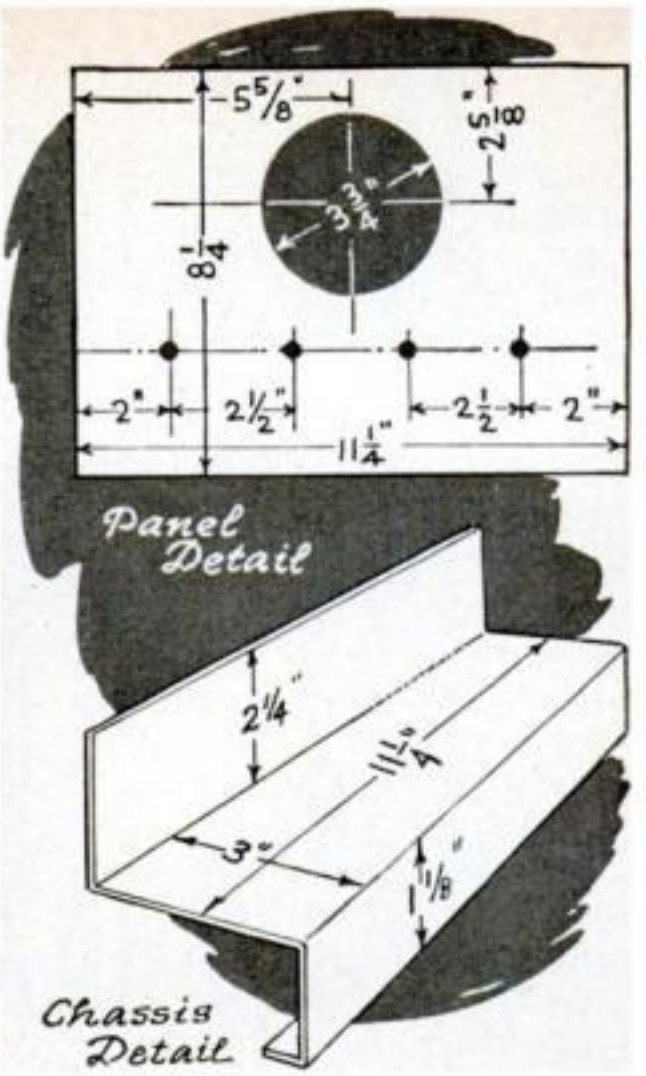


. . . and the schematic drawing below. Bias for the receiver is automatic





Metal chassis and speaker, mounted on a wooden panel, fit into the lower half of the suitcase along with the set's batteries



Panel and chassis details. Panel has a 3¾" hole for the speaker

they enable the receiver to operate at its best.

Single-pole, single-throw switches are mounted on the back of both the volume and regeneration controls. The one on the regeneration control turns the receiver on and off, while that on the 1-megohm volume control disconnects the grounded side.

Bias for the receiver is automatic and is supplied through the 600-ohm, ½-watt resistor and the 20-mfd. electrolytic by-pass condenser in the "B-" and "A-" circuits.

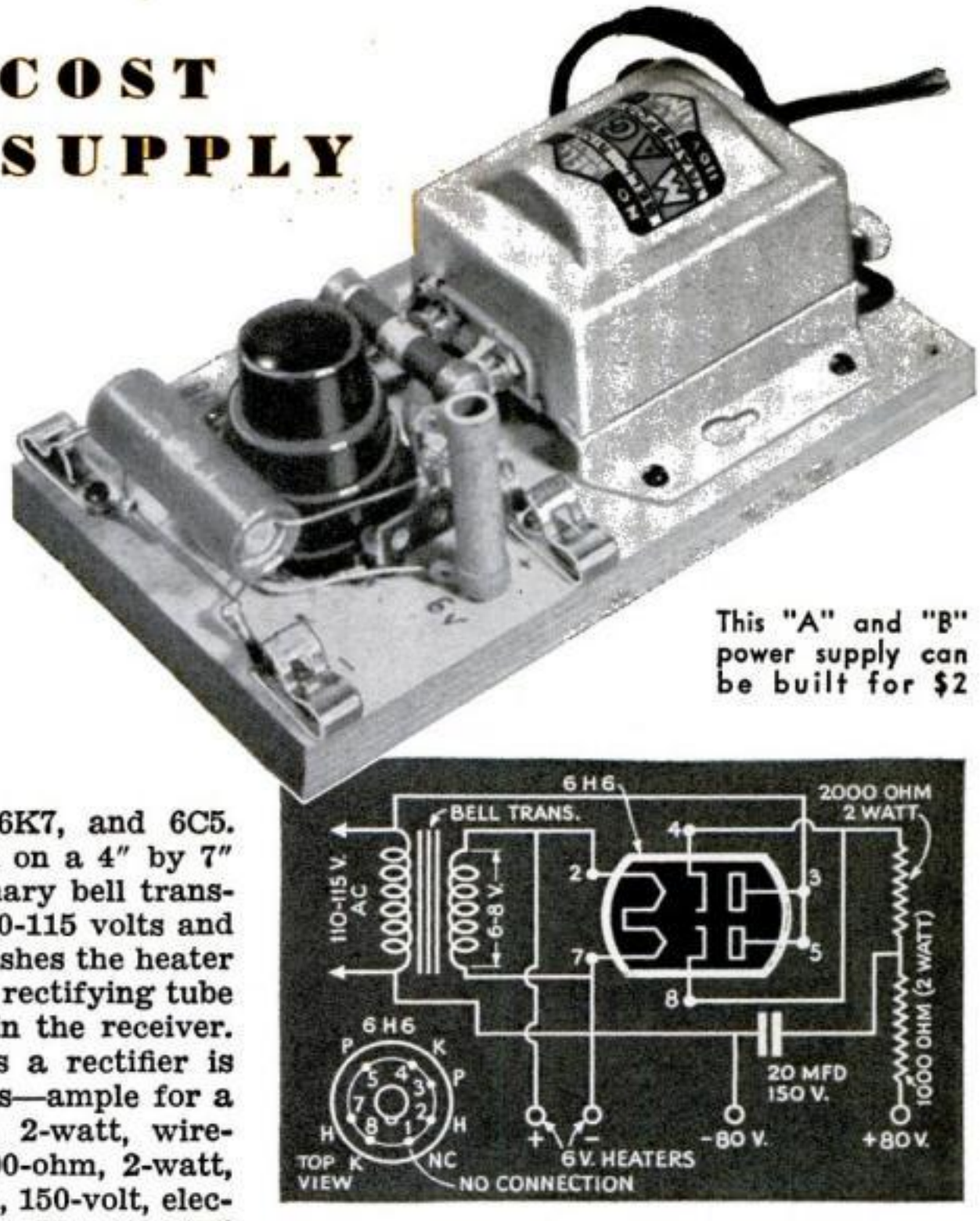
If more volume is desired from the set, the "B" power supply can be increased from 90 to 135 volts. Or a short length of antenna wire (about 10 feet can be connected to the grid side of the loop antenna.

The 9½" by 7½" loop antenna goes inside the lid of the case and can be concealed by paper if desired

LIST OF PARTS

Loop antenna, 9½" by 7½". Suitcase.
Tuning condensers, .00041 mfd.
Three-inch tuning dials (two).
Four-inch PM speaker.
Universal output transformer.
Six-prong plug-in coil.
Six-prong wafer socket.
Volume control, 1 megohm.
Regeneration control, 15,000 ohms.
S. P. S. T. attachable switches (two).
Diode-triode-pentode tube, 3A8GT.
Beam-power output tube, 1Q5GT.
Octal wafer sockets (two).
Carbon resistors (two), 2 megohm, ½ watt.
Carbon resistor, ½ megohm, ½ watt.
Carbon resistor, 200,000 ohms, ½ watt.
Carbon resistor, 4,000 ohms, ½ watt.
Carbon resistor, 600 ohms, ½ watt.
Electrolytic condenser, 20 mfd., 150 volts.
Paper tubular condenser, .05 mfd., 400 volts.
Paper tubular condenser, .006 mfd., 400 volts.
Paper tubular condenser, .003 mfd., 400 volts.
Mica condenser, .0005 mfd.
Mica condensers, .00025 mfd., .0002 mfd.
Midget 1.5 volt "A" battery.
Midget 45-volt "B" batteries (two).

LOW-COST POWER SUPPLY



This "A" and "B" power supply can be built for $2

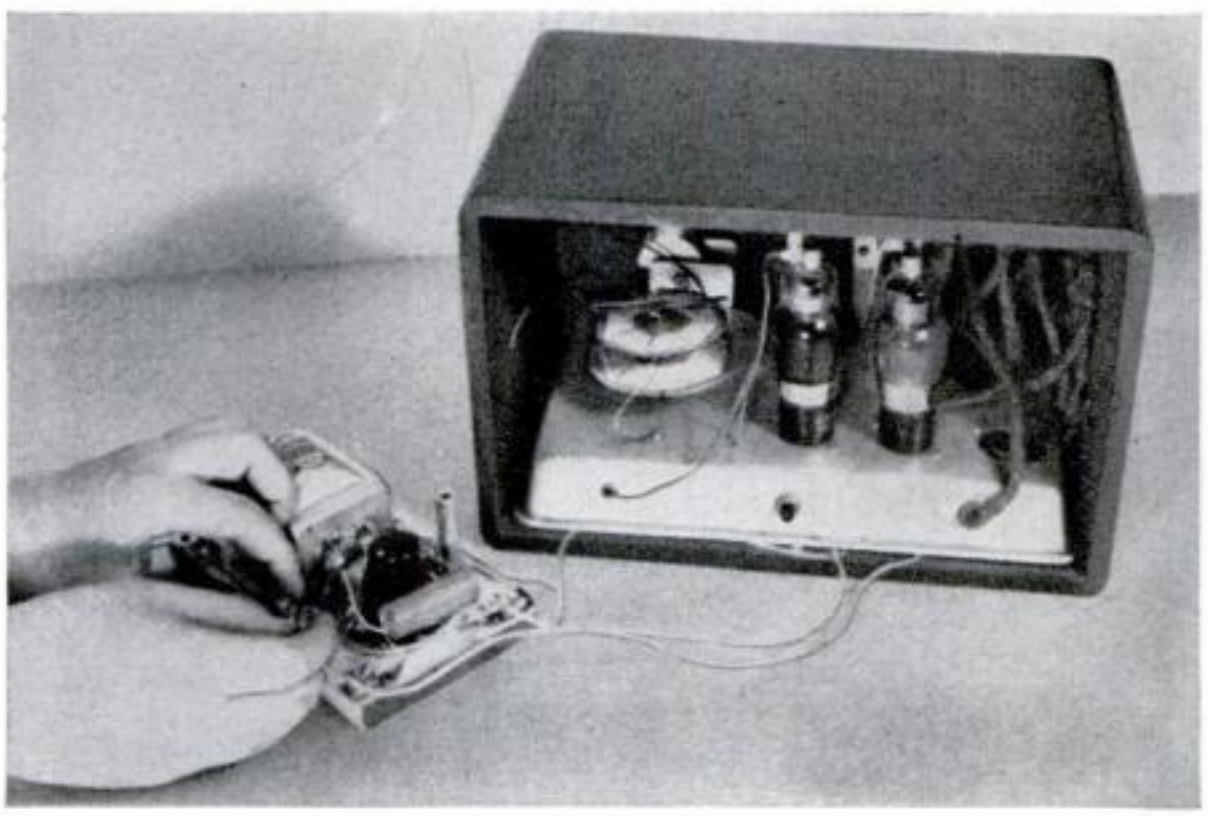
HERE is an "A" and "B" power supply that can be built for less than $2, and will operate any one or two-tube receiver not provided with a power tube. It will supply six volts of alternating current for tube heaters and approximately 80 volts of filtered and rectified direct current for plates and screens of tubes similar to the 6J7, 6K7, and 6C5.

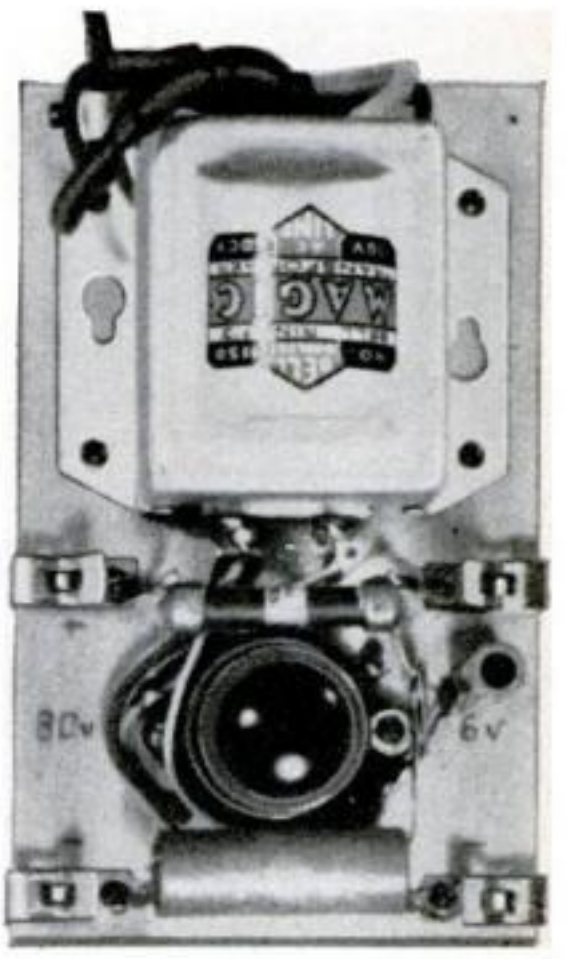
All the parts are mounted on a 4" by 7" wooden baseboard. An ordinary bell transformer with a primary of 110-115 volts and a secondary of 6-8 volts furnishes the heater supply for the diode detector rectifying tube (6H6) and the other tubes in the receiver.

The output of the 6H6 as a rectifier is approximately 8 milliamperes—ample for a two-tube set. A 2,000-ohm, 2-watt, wire-wound, fixed resistor; a 1,000-ohm, 2-watt, carbon resistor and a 20-mfd., 150-volt, electrolytic condenser are used to filter the "B" voltage. The 6H6 uses an eight-prong socket.

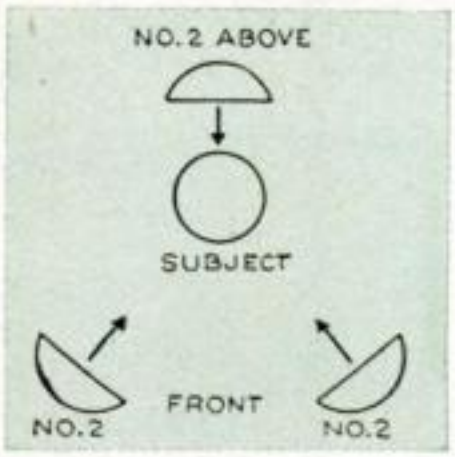
Plates and cathodes of the 6H6 are in parallel

The plates and cathodes of the 6H6 are connected in parallel, with plates hooked to one side of the transformer primary, and the cathodes connected to the filter circuit. No ground connections should be made to the receiver, as it will be grounded through the power supply, which is connected to the house-wiring circuit.

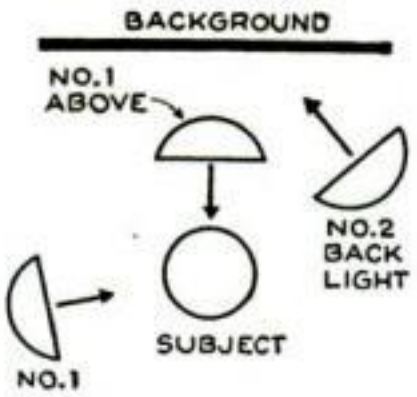




An ordinary bell transformer furnishes the heater supply. At left, hooked up and ready to go, showing its small size



The portraits on this and the facing page were made for comparison with the famous paintings of old masters shown. The above photo of a living model illustrates how the poise and vitality of El Greco's "Mater Dolorosa" have been recaptured for the camera. Lighting plan and sizes of flood lamps used for the photo appear at left

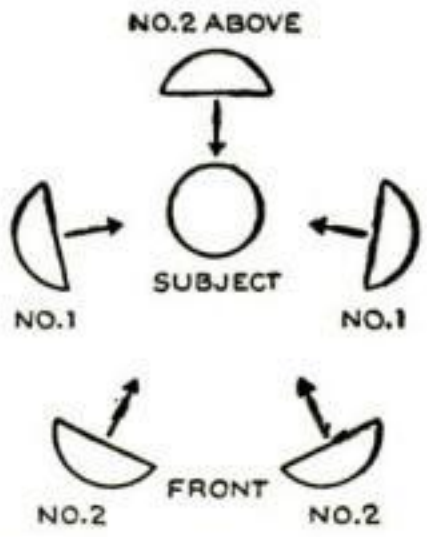


Hints on Posing Better Portraits

WHEN your photography becomes a bit stale and you lack inspiration, you can get a great lift by thumbing through a book of reproductions of paintings by the old masters. Better still, visit the painting galleries of an art museum.

The old masters knew something about posing, composition, and lighting. If you will look at their pictures with a view to applying some of their methods to your own photographic studies, your work will gain pictorial quality, breadth, and simplicity. It is not a matter of merely copying some famous painting photographically, but rather of using the same principles of posing, composition, and lighting to create an original study.

The lively charm of Greuze's "Young Girl" is evident in the modern miss pictured below. At top of page, a portrait posed after Gainsborough's "Mrs. Siddons"



A. Reinhardt, the New York photographer who took the examples illustrated, believes that amateurs and professionals alike can learn much by observing the work of artists.

"In these pictures," he says, "I have photographed models in the same poses as those used in the paintings I was studying, but without special backgrounds or lighting effects. It is not necessary, of course, to make as close a copy as I have done. The important thing is to get some of the fine quality of the old masters into your own photographs."

The North Star is easily found by following an imaginary line through the two stars indicated, for a distance five times as great as that between them

Taking Star Photos

WITH AN ORDINARY CAMERA

By CHARLES H. COLES

Chief Photographer of the American Museum of Natural History, New York

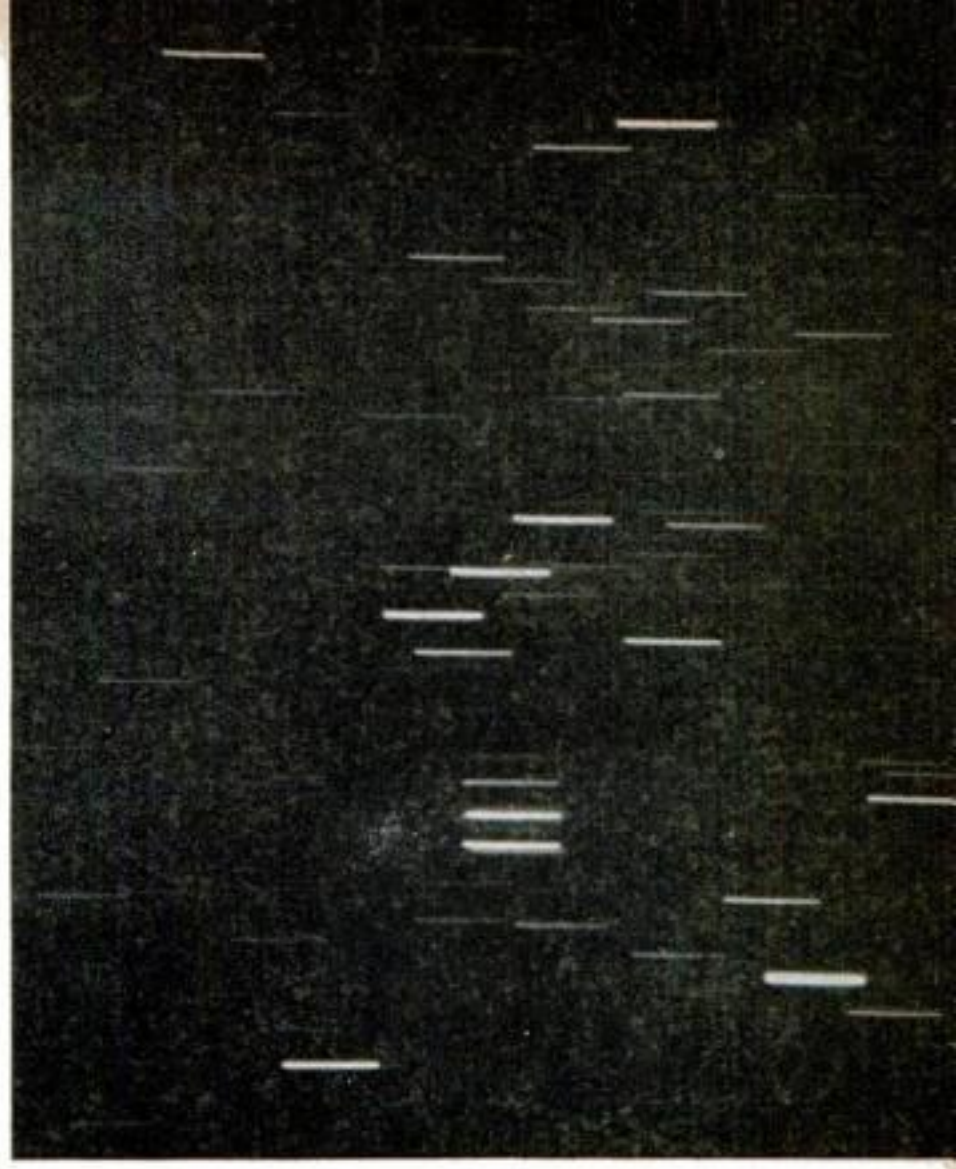
THERE is a strange fascination to making star photographs. The sky photographer tries it time and time again. Perhaps this is because it is so refreshing and reassuring to turn to photographing something as changeless as time and enduring as eternity.

Many stars invisible to the naked eye may be photographed with an ordinary camera in two ways without using a telescope. The simpler method requires no additional equipment at all.

Almost any camera will serve, but a fast lens will produce sharper and more contrasty negatives. Load the camera with fast panchromatic film such as Super-XX or Superpan Press, and mount it upon a tripod with a tilting top. With the lens set for infinity, point the camera toward an interesting group of bright stars, set the shutter for time and the diaphragm at its widest opening, and make an exposure of fifteen minutes.

Very interesting photographs can be made by aiming directly at the polestar and making an exposure of an hour or more. It is easy to find the North Star (Polaris) by the method shown in an accompanying diagram. When the film is developed, you will see that the movement of the stars has caused the image of each one to make what is known as a "star trail." The trails near the polestar are sharply curved, those farther away less curved, and those along the equatorial belt of the sky quite straight.

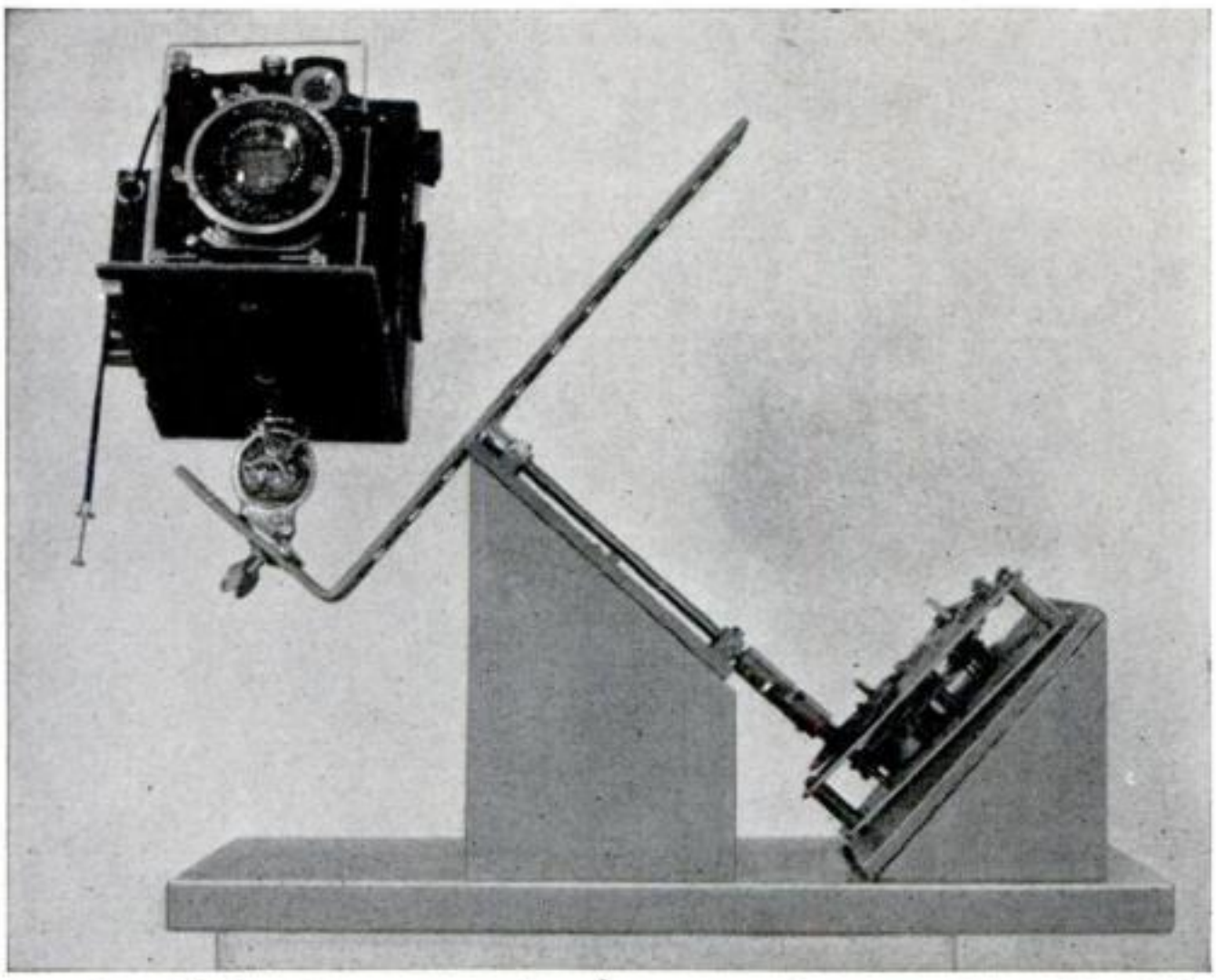
Although these star trails resemble nothing we actually see in the sky, I was content for many years to make pictures of this kind, not only of stars, but also of comets, planets, and eclipses, with a stationary camera. Then I took up the second method of star photography. In this, the camera is mounted upon a shaft parallel to the earth's axis so as to turn in the direction



At left, five-minute exposure of Orion made with a clock-driven camera. Individual stars in this photo are seen as streaks in the one at the right, made with a stationary camera and a seven-minute exposure

opposite to that of the earth's rotation. The effect of the latter is therefore neutralized and the stars will appear on the film as the familiar dots of light we know. The shaft or polar axis must make one revolution in about 24 hours.

For my own apparatus I was fortunate enough to obtain a clockwork from a recording voltmeter. The shaft of this turned at exactly the desired speed, whereas the hour shaft of an ordinary clock makes two revolutions every 24 hours. Such a clockwork can be used, however, by gearing the polar axis to it in a ratio of one to two. Either pulleys with a cord or belt drive, or fine-toothed gears may be used. Gears with large teeth will be unsatisfactory as these produce a jerky motion, which results in blurred star images.



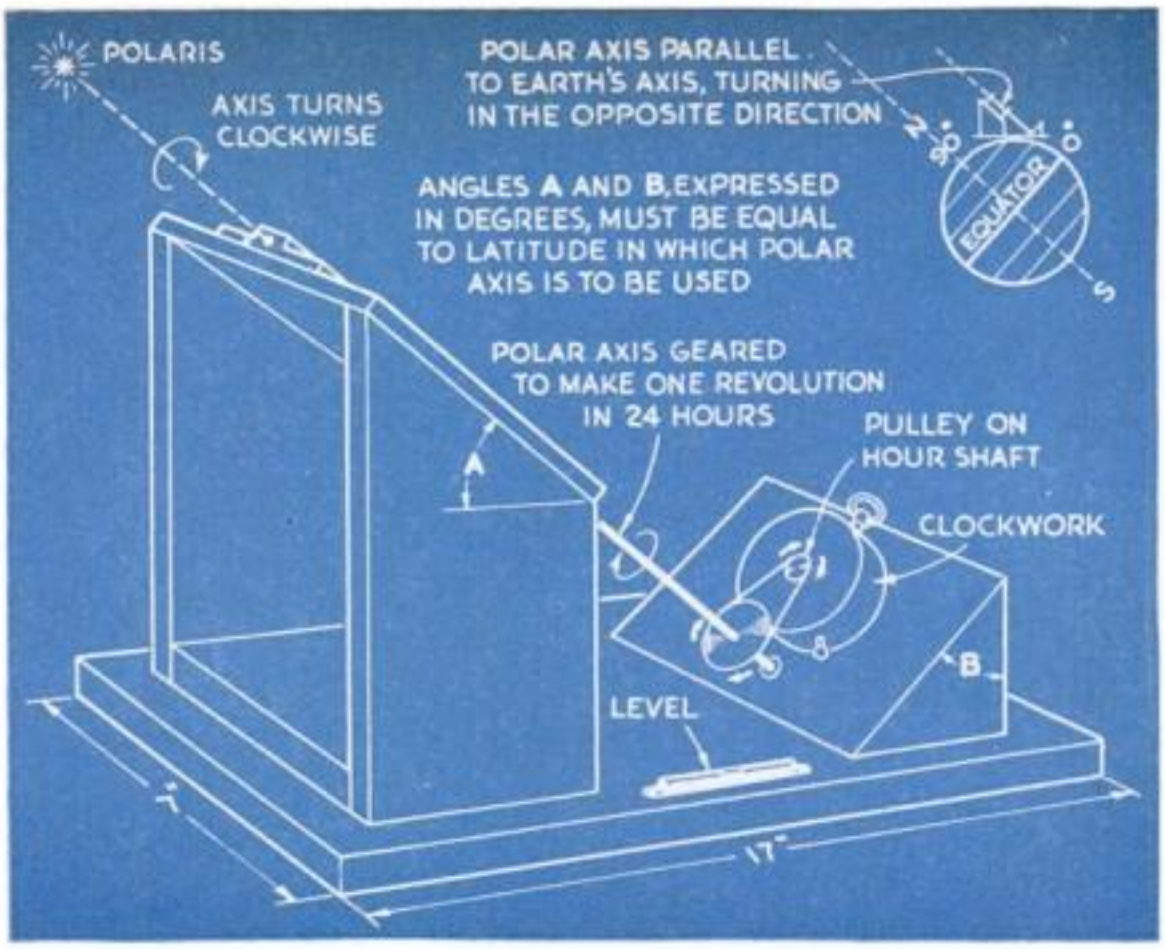
An adjustable bracket permits a heavy camera to be mounted in perfect balance. Lubricate clockwork with kerosene in cold weather. Oil may congeal

For the shaft I used a 7" length of ¼" drill rod, mounted in two small bronze bearings that were screwed to a 6" square of pressed composition wood. This was fastened to two supporting pieces of wood so that the angle between the shaft and the wooden base, expressed in degrees, was equal to the latitude in which the mounting was to be employed—in this instance, 41 deg.

The upper end of the shaft was threaded with a ¼"-20 die to fit a standard tilting top, and a small collar with a set screw slipped on to

take the end thrust. The axis was connected to the clockwork through a small universal joint. The rotation of the shaft, as seen from the camera end, should be clockwise.

A light camera may be mounted directly on the shaft by means of the tilting top, but in using a large camera I found it was too far off balance to operate smoothly. To remedy this, I use an L-shaped piece of strap iron with a number of holes tapped ¼"-20 at intervals of 1" in both its legs. This is screwed to the polar axis as shown in two of the photographs, and the camera is mounted by means of the tilting top to the shorter arm. By using the proper holes, it is possible to adjust the camera so that the entire assembly will be in balance.



The builder can ascertain his latitude from a map. Note that the axis, but not necessarily the camera, must point to the polestar

I usually fasten this equatorial camera mounting by means of a C-clamp to the top of a small four-legged stool, which is then carefully leveled. The polar axis is pointed directly at the polestar. If the latter is invisible from where I stand, I use a magnetic compass to orient the polar axis in the north-south plane. The deviation from true north involved in this method is not important in view of the short exposures used.

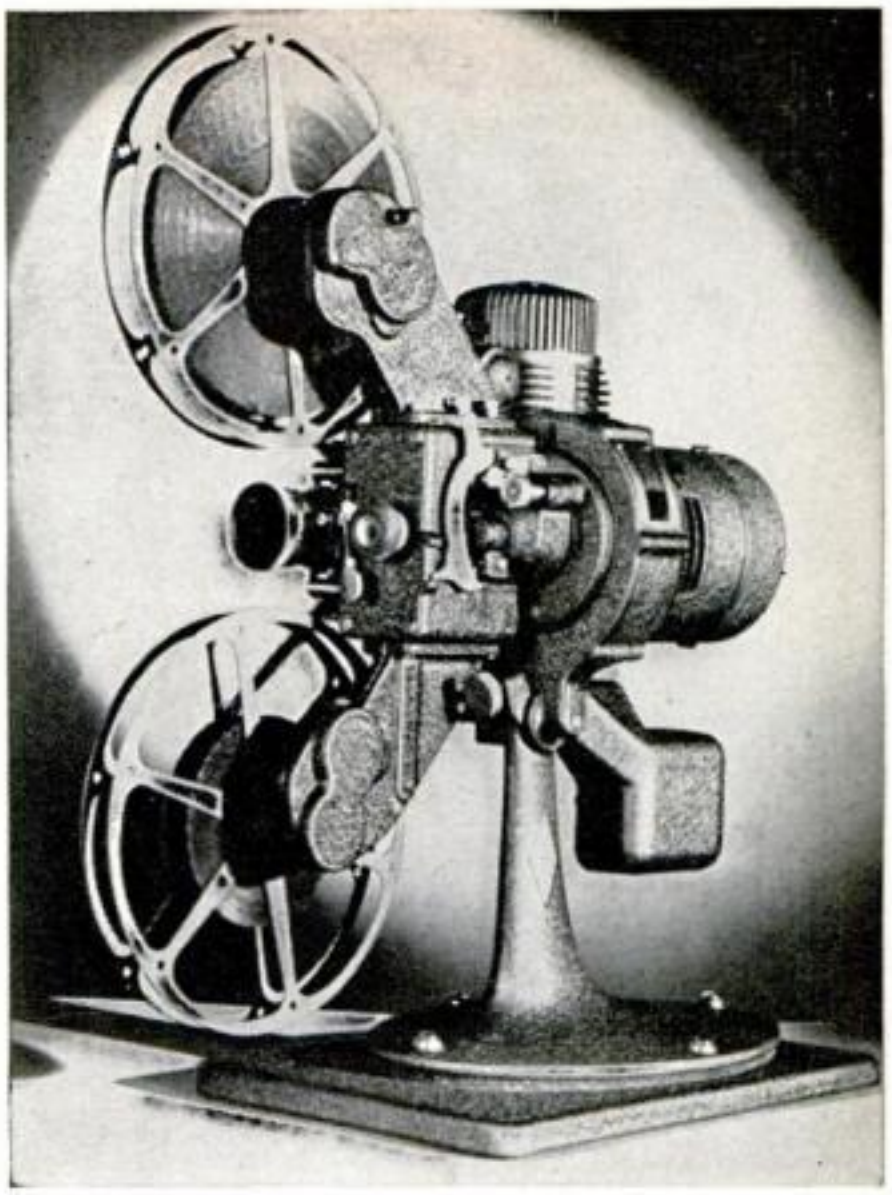
The camera is mounted, pointed at the stars I wish to photograph, and the clockwork allowed to run for ten minutes to take up the slack in the gears before I start making exposures.

My camera has an f/4.5 lens and takes a 9 by 12 cm. plate or film. I have found that plates afford sharper images than film because their emulsion is accurately flat. To hold exposure time to a minimum, I use the very fastest plates now available—Super Panchro-Press. Orthochromatic emulsions register too much background light because of their high sensitivity to blue. I usually expose for three minutes, with the lens wide open, and have obtained excellent star photographs in this length of time. Exposures as short as 15 seconds will record bright planets, whereas such faint objects as comets or dim stars may require five minutes or more. It is advisable, especially when working near big cities, to use a lens shade. This will help materially to reduce fogging from artificial lights.

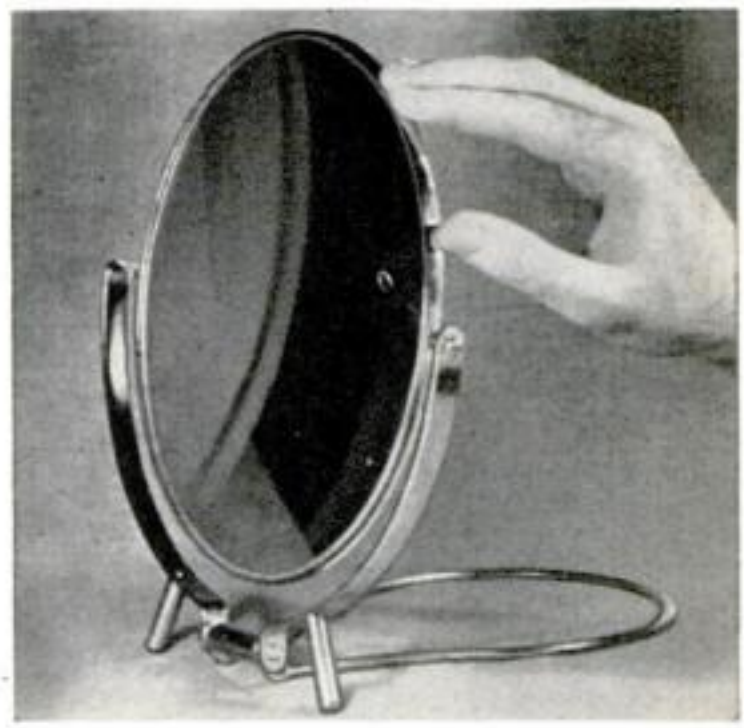
Comet 1941 C (Paraskevopoulos) photographed with a clock drive. The exposure was five minutes

FOR CAMERA USERS

SOUND FILMS may now be run on all the new 16-mm. Filmo silent projectors. The elimination of one set of sprocket teeth makes it possible for the sound film to be drawn through the silent machine the same as it would be through a regular sound machine. Although the sound, of course, is not reproduced, this improvement opens a vast field of entertaining and educational films which are available only in sound versions. To feed such film into an ordinary silent machine would ruin the sound track.

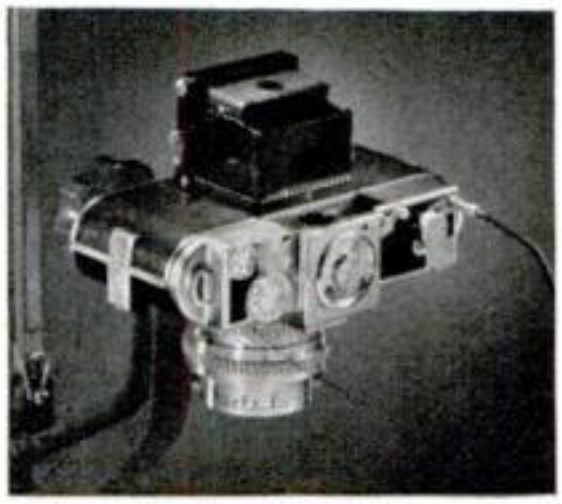


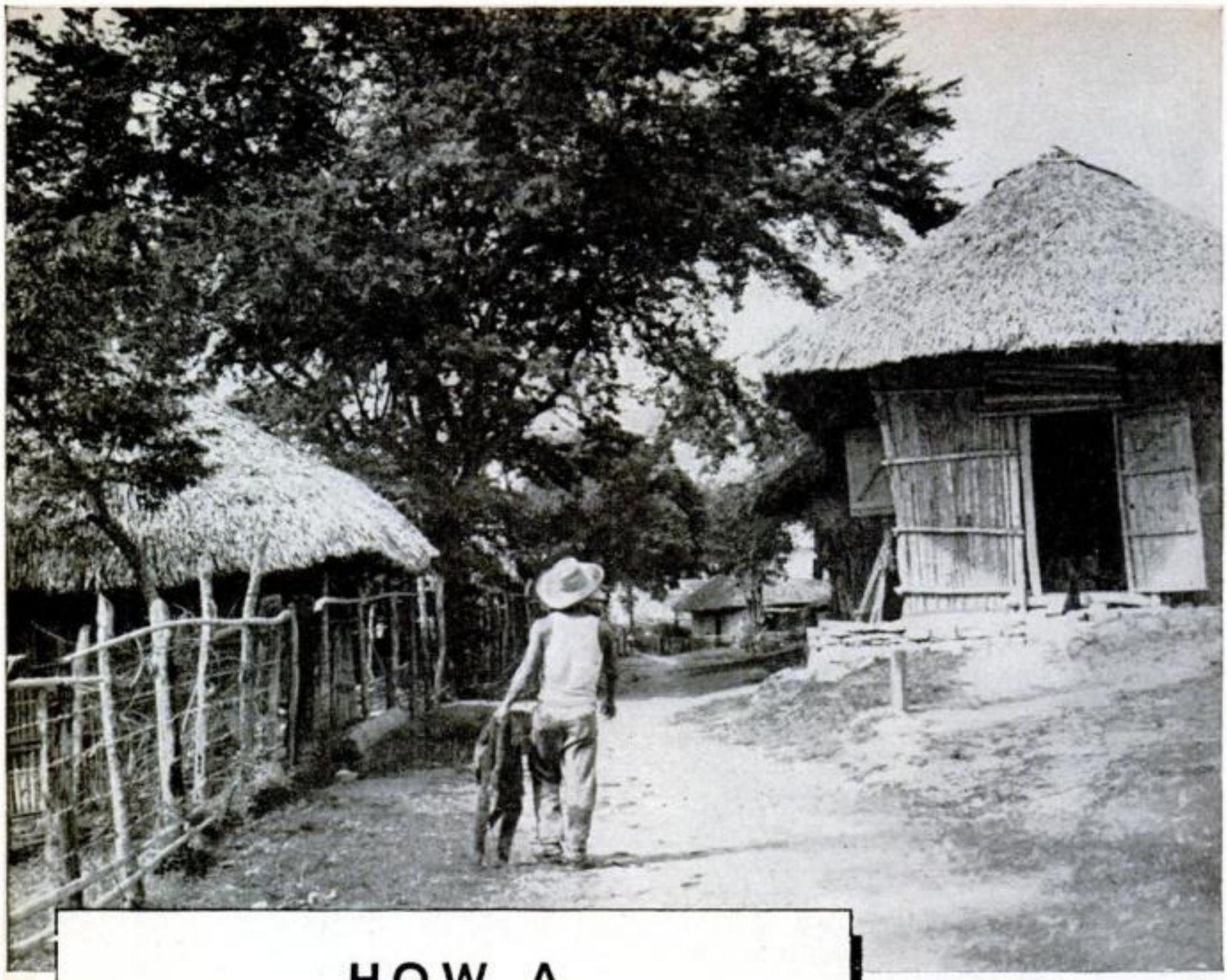
FOR EXPOSURES in sunlight or ordinary daylight, this new reflector provides convenient and easily controlled supplementary illumination. It is especially useful for lightening the shadows in side-lighted or back-lighted photographs. The reflector consists of a 9″ convex mirror shaped to the curvature of a 40″ diameter sphere. It reflects a beam of light approximately 10 deg. across, and is mounted on an adjustable support which allows it to be placed at any angle. By its use the photographer can direct a spot of light into the deep shadows where it is most needed, and can vary the area and intensity of the illumination.



A close-range finder permits focusing down to a foot and half. Right, the new ground-glass focusing back

SIX ACCESSORIES are now available for the new American-made 35-mm. Ektra camera (see P.S.M., Mar, '41, p. 217). These include a special flash synchronizer, ground-glass focusing back, view finders for high, low, and right-angle work, a close range-and-view finder, and a special tripod clearance head. The right-angle finder is designed for obtaining unposed shots and shooting in cramped quarters. The ground-glass focusing back incorporates a magnifier, and a mirror which can be set at a 45-deg. angle for focusing as in a reflex-type camera.





This Mexican lane would have been dreary indeed without the human figure in the foreground to add a touch of life and action

HOW A

Hollywood Cameraman Takes Home Movies

By ANDREW R. BOONE

HOLLYWOOD knows Arthur Miller as the man who would rather grind out a desert scene with his home-movie outfit than take intimate close-ups of the most glamorous stars west of the Rockies.

For more than a quarter of a century he has been filming professional movies, starting with twenty episodes of "Perils of Pauline" in 1913, and achieving his greatest triumph to date in filming the two-million-dollar "Brigham Young" in color.

But Arthur Miller gets a bigger thrill from seeing his newest amateur film than he does from witnessing the day-by-day "rushes" at the 20th-Century Fox studio. During vacations and nearly every week end he loads his 8-millimeter camera, hangs a light meter about his neck, and departs on a photographic expedition of which he is cameraman, director, and producer. As a result, while filming four big professional pictures every year, he takes a dozen home movies of from one to four reels, and involving from 12 to 60 scenes each.

With vast studio lighting facilities at his disposal, this veteran prefers to shoot outdoor scenes, building up their dramatic values with shadows, clouds, human faces and figures, and other "natural props." He works in both black-and-white and color, reserving the latter for cloudless or dull days when light and shadow contrasts are

too low for the most effective results in black-and-white photography.

How does this expert plan a home movie and carry it through to a logical, satisfying conclusion? Exactly like the big Hollywood producers, except on a smaller scale. Here is his method:

Write a scenario. Don't let this beginning frighten you, for a scenario or continuity or shooting script is simply a record of your thoughts, jotted down as the picture takes form in your mind.

Decide upon your locations. Seek out likely spots, taking time if possible to see them in the beautiful cross lighting of early morning and late afternoon.

Choose your wardrobe. You need not buy special clothing, but you should select apparel to harmonize with the settings. Never discard any clothing until the film is completed, in case retakes are necessary. In color sequences pastel shades are desirable, and large red garments should be avoided if anything else is to be seen.

Start the picture. Follow your continuity, but don't be afraid to deviate from it when interesting shots turn up unexpectedly. Anything and everything is meat for the amateur movie maker, Miller believes.

For example: Once his family asked to be taken on a desert outing. The same evening Miller made his scenario notes, and actually started shooting by photographing a map of areas in which wild flowers were to be found in bloom.

The map itself served as the main title. From it he cut to his cocker spaniel looking out a front window, to his wife closing the window, the children gathering their sports clothing, the car moving out of the driveway. This was followed by scenes along the road and, at their desert destination, a shot of his daughter pointing toward a field of yuccas in a spirit of gay delight.

Here the picture gains momentum. It cuts back and forth from long shots of flowers to close-ups, and at last a long shot with snow-covered mountains in the distance. Miller is seen waving goodby, and after a road shot of the climbing highway you're in the snow. On the return trip, occasional glimpses of thinning snow patches picture the descent, and finally Miller is shown throwing a snowball among the flowering yuccas. The picture fades out on the flowers receding into the distance behind the homeward-bound car.

Simple, effective, colorful, this travelogue covers four reels, a total of 200 feet. The running time is 15 minutes, and there are 60 scenes. In general, this expert points out, the movie maker will achieve proper balance by exposing close-ups by a long count of five, and long shots by a long count of ten—requiring 15 and 30 inches of film, respectively.

Another example of Miller's work is his recently-finished single-reeler titled, "The Big Race." This portrays a handicap event. It opens with a close-up of a newspaper story announcing the entries, and closes with a shot of the winner being decorated with a garland of roses.

The newspaper clipping constituted a natural title. It was taped to a wall and copied under a floodlight. From this, Miller cut to a close-up of the program, continued with two long shots of the grandstand, and followed with a few intimate scenes showing his son eating a hot dog, an old lady with a program, and a man reading a form chart.

After these he shows the jockeys weighing in, "swipes" saddling the mounts, a bugler announcing the race, horses parading, and the start. To show the race itself, Miller used scenes from half a dozen sprints, the entire sequence leading up to the finish.

"Such pictures," he confesses, "help

In an improvised darkroom over his garage, Arthur Miller develops countless reels of 8-mm. movies

Using side lighting, Miller copies headlines and a newspaper photo as a title for a horse-race movie

greatly in planning the composition and balance of professional productions. Ideas change, and I can try new techniques with the 8-mm. I'd never dare attempt on a set where the production cost may run as high as $20,000 a day."

Once a close-up meant filling the screen with a face. Today a face occupying only one fourth of the screen is considered a close-up. Interest centers upon the face, yet the visible background should be chosen to help give character to the subject.

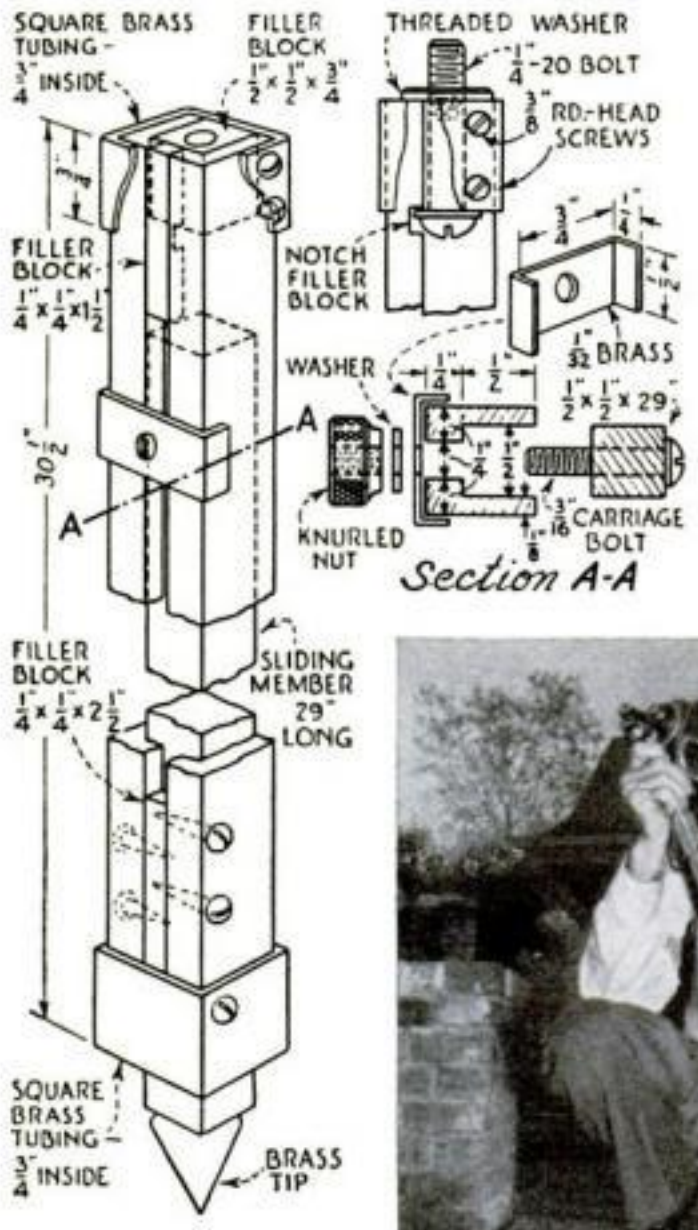
"Shoot long shots with the standard 12½-mm. lens," he advises, "but change to a 1" or a 1½" lens for close-ups to avoid distortion. Try to keep people in most scenes. To introduce a static long shot, first show someone in the foreground, cutting to the mountains or river or plain as he sees them. Although a bald sky should be avoided in black-and-white, clouds are not essential with color film.

"Use a light meter on all scenes. If it's a close-up, take the reading 12" from the face. On long shots, hold the meter at the camera and tilt it 10 degrees below the horizon. Use a tripod or speedpod on all scenes."

Miller willingly explains his preference for the single-leg support. He became a home-movie enthusiast four years ago when he won a $19 outfit for 8-mm. film at a raffle. After shooting a few scenes of Shirley Temple in "The Little Colonel," he traded the camera in for a better one, and took a bus trip through the West. The conventional tripod proved difficult to swing into action quickly during brief stops, and upon returning home he spent some time in his workshop fashioning a "speedpod." For good measure he fitted it with a tilting top.

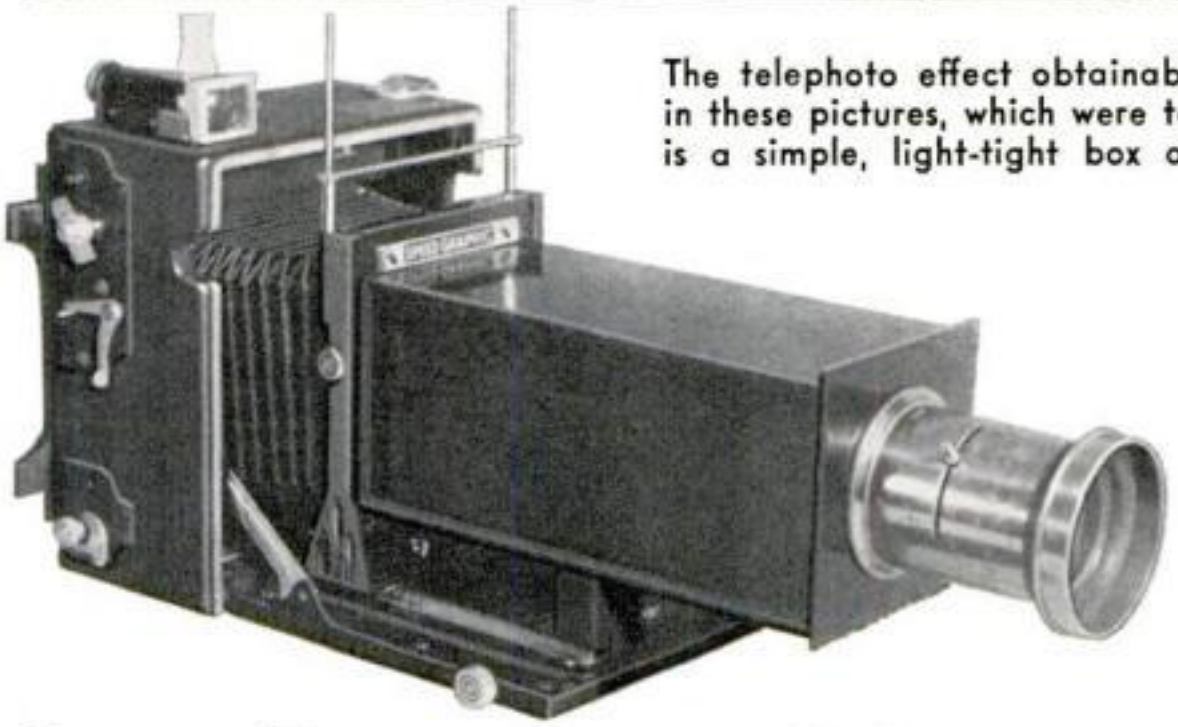
Internationally famous for his professional cinematography, Miller relies upon a few simple rules in his 8-mm. work. "Characters, location, and clouds are all one needs," this veteran nature lover declares, pointing to the outdoor scenes in "Brigham Young" as an example. Many of these he photographed amid the breath-taking beauty of Big Bear Lake and Lone Pine, with majestic Mt. Whitney in the background.

Readily Constructed Speedpod Steadies Movie Camera



The speedpod mentioned in the foregoing article is instantly adjustable in height from 31" to 56". Its construction can be easily duplicated by anyone who has access to a bench saw or can get the long members ripped to shape by a cabinetmaker. Maple, birch, oak, or any straight-grained hardwood may be used. The outer frame members are joined at the bottom by a filler piece ¼" by ¼" by 2½" and at the top by a similar but shorter piece in addition to the ½" square block in which the tripod screw is anchored. These blocks should be well glued and further secured by small brass screws, those at the top passing through a short piece of square brass tubing, ¾" inside measurement. Stagger the screws. A large rubber-headed tack might be substituted for the pointed tip shown. If the camera is held firmly against the forehead when one is using the speedpod, its leg becomes the third leg of a tripod of which the photographer himself supplies the other two.

The telephoto effect obtainable with a long-focus lens is apparent in these pictures, which were taken from the same spot. The adapter is a simple, light-tight box attached to the front of the bellows

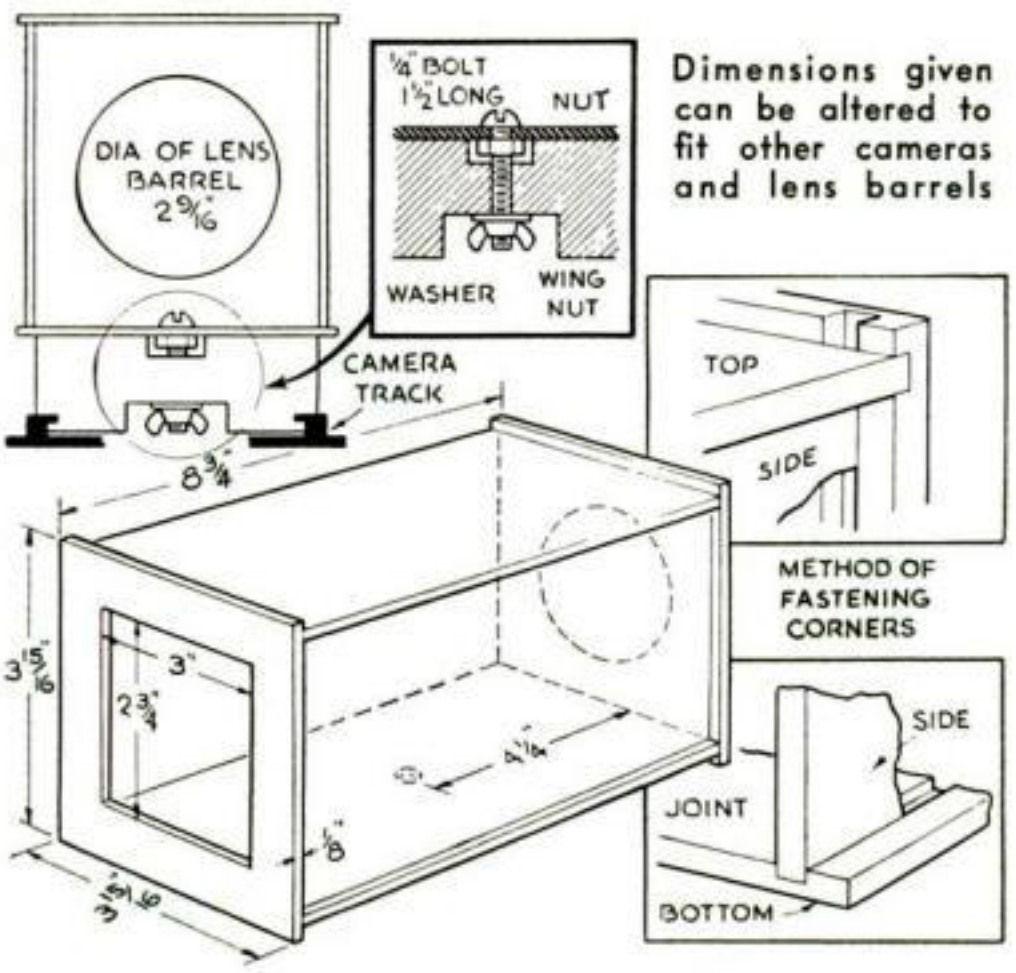


Long-Focus Lens Adapter

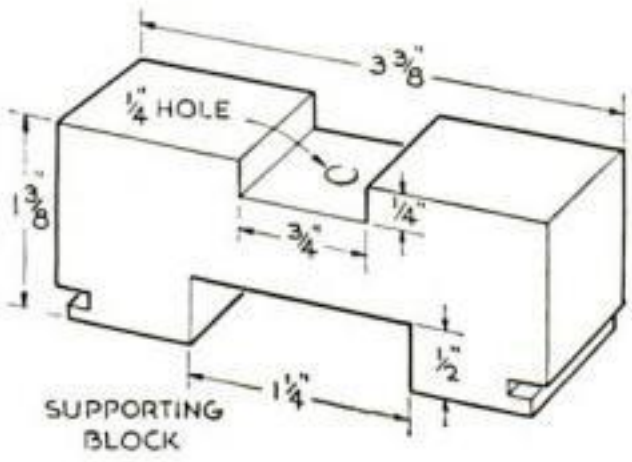
INTERESTING telephoto effects are possible with a long-focus lens used in a ground-glass focusing camera. Mine is a 4" by 5" Speed Graphic, and I was fortunate in obtaining for five dollars a 16" focal-length, f/8 process-type lens, which will bring into sharp focus any object eight feet or farther away, with a magnification of 2 2/3 over the image size obtainable with the regular lens.

Dimensions shown in the accompanying drawings are those actually used in making the adapter for the camera and lens mentioned, but can readily be changed to suit others. To determine the length of the extension box required, first focus as usual upon an object more than 100 feet distant. Without changing the bellows setting, remove the standard lens and move the long-focus lens in front of the bellows until the image on the ground glass is at its sharpest. Measure from the back of the lens flange to the front of the bellows. Height and width of the box can be estimated from the dimensions of the lens board.

Use poplar or other tough, close-grained wood, grooving the pieces on a circular saw to form the simple, light-tight joints shown. Glue the parts securely together. As I was



Dimensions given can be altered to fit other cameras and lens barrels



unable to get a threaded lens mount, I cut the hole in the front of the box to a close fit for the lens barrel, and pressed the latter tightly into place.

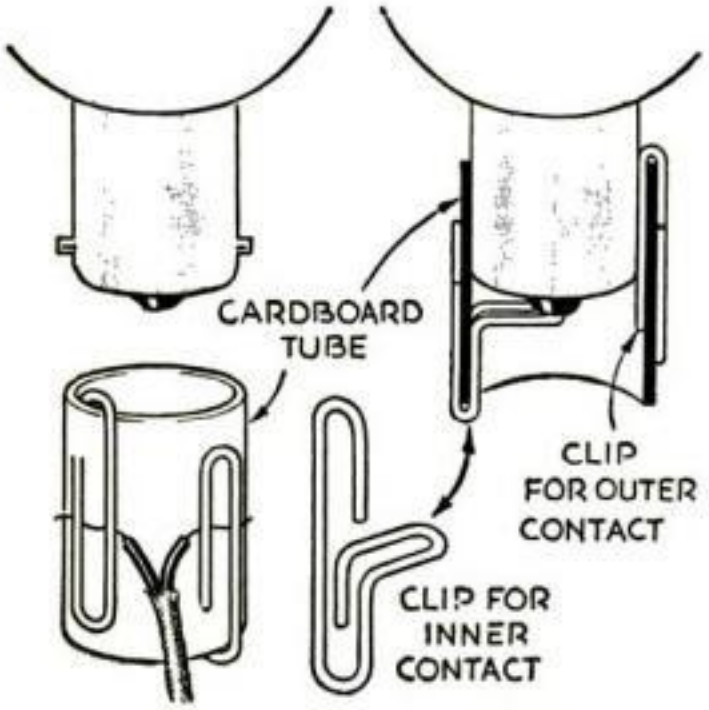
A block was cut to fit over the bellows track and support the front end of the box, to which it was fastened by means of a bolt and a wing nut.

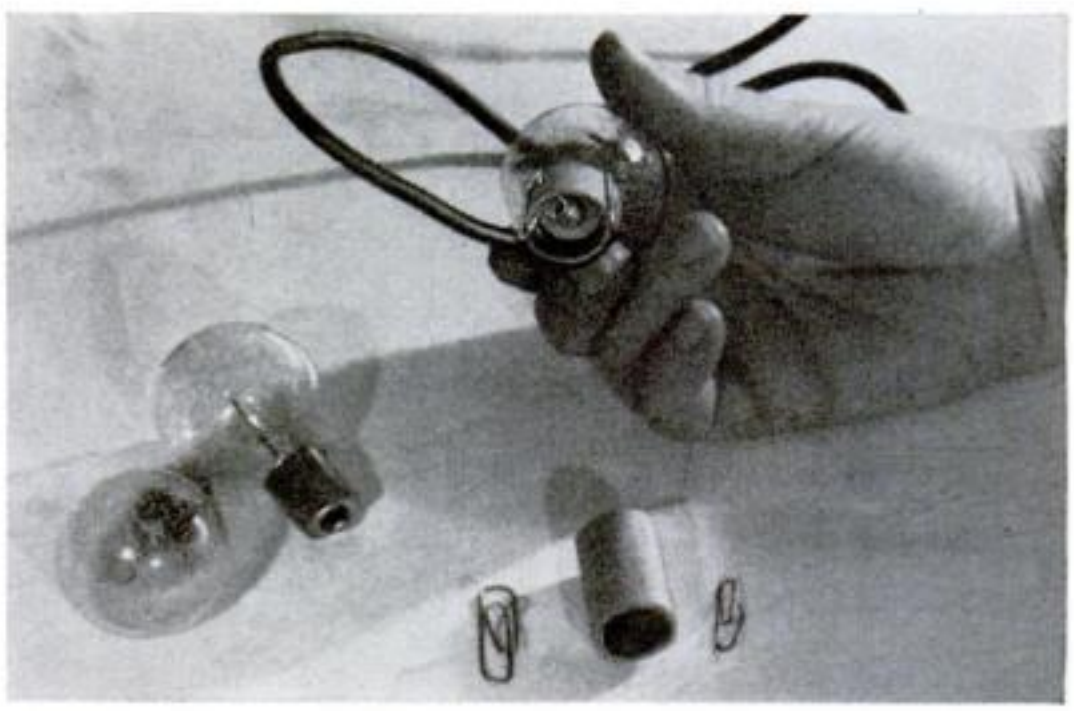
The inside of the extension box was painted a dead black to kill reflections, and the outside finished in gloss black, well sanded between coats.

In using a tripod with this unit, exercise care in setting it up and focusing, as the long adapter tube and heavy lens tend to make the assembly top-heavy, especially on those occasions when the bellows is racked out for close-up work.—ARTHUR C. SIMMONS.

Clips and Cardboard Form Socket for Midget Flash Bulb

AMATEURS who like to take multiple flash pictures with the new midget bulbs often have difficulty finding a socket for the extension cord. A simple solution is to roll a strip of cardboard into a small tube to fit the base of the bulb, and place a paper clip over the edge to hold the ends together and serve as one contact for the bulb. The inner loop of another clip is bent so that it makes contact with the terminal at the base of the bulb. The wires of the extension cord are slipped under the clips on the outside, or they may be soldered to them beforehand, if time permits.—LOUIS HOCHMAN.



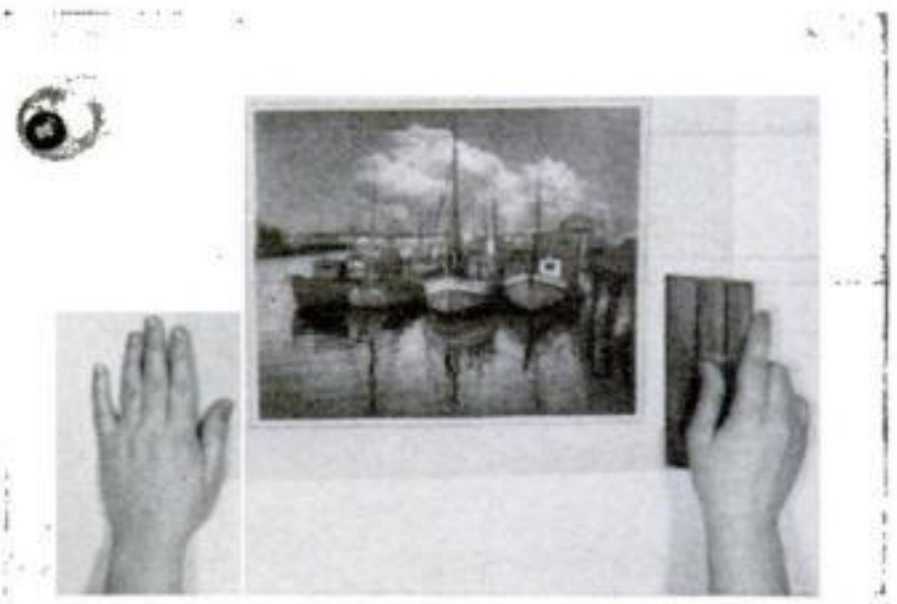


Gelatin Film Betters Quality of Photographic Prints

SOME photographic papers, when dry, fail to show shadow detail that appeared on the wet print. To restore such detail, pour on a five-percent gelatin solution and squeegee over it a wet sheet of Cellophane, as below. Peel this off after the gelatin sets.—F. McC.

Pencil Under Developing Tray Insures Better Agitation

FILMS and prints insufficiently agitated during development are likely to be spotty and poor in tone. Lifting one end of the tray often results in spilled solution, but if a round pencil or piece of dowel is placed under it, as above, the tray can be rolled back and forth without spilling, and with little effort.—JOHN C. WORKLEY.



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Gus Chases a Jinx

(Continued from page 136)

light I did. You've bent your shift lever a little so that, when you push it forward hard going into second, it hits the ignition-key case, lifts it sideways, turns off the switch and stops your engine. Watch again."

Gus shifted gears hard, raising the key case, and the engine went dead. Then the weight of the key case slowly brought the key back to "on" position.

"Well, there's your jinx, Mr. Conroy," he said. "When we get back I'll chase it for good by straightening that lever."

Conroy was silent for a few minutes. "What I don't understand," he said at last, "is why it is only after I stop for a light that I jam the end of the gear-shift lever against the ignition key. Why don't I do it *every* time I shift from first to second?"

Gus laughed—that friendly laugh of his that never has any sting in it. "You're pretty high-strung," he said. "And you think that most traffic lights are unnecessary nuisances—you told me you do. Having to stop at one makes you sore, and unconsciously you work off your impatience by slamming your gear-shift lever around."

Ten days later Joe Clark again called Gus to the office telephone and, as always, Gus went unwillingly.

"Is this Dr. Gustav Wilson?" asked a voice. "The distinguished nerve specialist?"

"Hey?" demanded Gus. "No, this—say, what's the gag? . . . Oh, it's Doc Foley, is it? What can I do you for, Doc?"

"You can tell me what you did for—and to—that fellow Fred Conroy," Dr. Foley said.

"Conroy," Gus repeated. "Oh, that's the fellow with the jitters, isn't it? Why, I just fixed up his car so that it is fit for a human being to drive."

"How about chasing that jinx Conroy thought he had after him?"

"That was just a little fancy trimming," Gus said. "How is the poor guy, anyhow?"

"I wouldn't say he's cured, but his nerves certainly are in much better shape than they were before you fixed up his car. He's doing better with his selling, too—says he's going to pay part of your bill next week."

"Shucks!" Gus growled. "He needn't get gray hairs about that bill. You really think fixing his car up did his nerves any good?"

"I'm sure that it did," Dr. Foley said decisively. "That experiment has convinced me that driving a noisy, out-of-whack car is a serious nervous strain."

"You've got something there, Doc!" Gus said. "I found that out 25 years ago—without going to medical school!"

Back to the Helicopter

(Continued from page 63)

to $35 for Sikorsky himself, but wages were seldom collected. The most remarkable economies were practiced. A set of precision shears for cutting duralumin were made from an automobile bumper, bought in a junk yard for 50 cents. Completion of the ship was made possible by Sergei Rachmaninoff, the pianist, who gave $5,000.

On May 4, 1924, the great gleaming metal ship, with 69-foot wing spread, was ready for flight. It took off in fine shape, but then one of its two pathetic secondhand 200-horsepower engines began to miss. Sikorsky brought it down on a golf course, and it nosed over in a bunker.

Sikorsky got his stockholders into a room, locked the door, and by main force squeezed out pledges of $2,500 with which to continue his work. Powered with Liberty motors, the S-29 first flew successfully the following September. It carried 14 people. It freighted grand pianos from New York to Washington as a publicity stunt. Thousands of people, including this writer, made their first flights in the S-29. Renamed the *Yorktown,* it toured the country selling rides. It wore out three sets of motors before it was destroyed in the movie "Hell's Angels."

Sikorsky's troubles were not over. In 1926 he built the trimotor S-35 in which the French ace, Rene Fonck, planned to fly across the ocean to win the Raymond Orteig trophy. But when the great ship, overloaded with fuel, trundled down the runway, part of its landing gear broke and it nosed over in a gully at the edge of the field and burned.

During the next few years Sikorsky built and sold numerous planes, amphibians, and then flying boats. In 1929 the United Aircraft Corporation bought his company, and built a plant for him. His second clipper, the 22-ton S-42, pioneered on both the Atlantic and Pacific runs of Pan-American Airways. His S-40 was the clipper originally used in the South American service.

Today Sikorsky is building three big flying boats, with which the American Export Lines plan to establish nonstop flying service to Europe. That's a man-size job in itself, but to Sikorsky it is no more important than is his helicopter. With that he expects to make his boyhood dreams come true.

His most recent step in that direction was made on April 17 when the helicopter, transformed into an amphibian by the addition of floats, rose from the waters of the Housatonic River and made a landing on the shore without damaging the floats.

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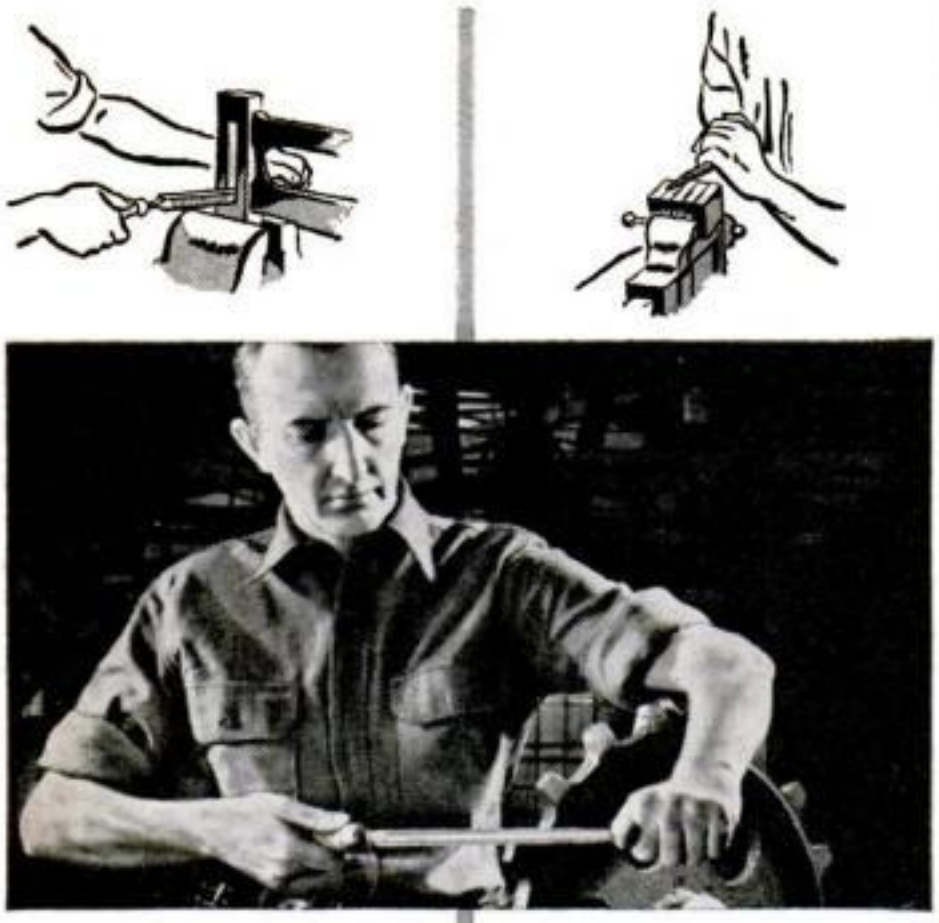

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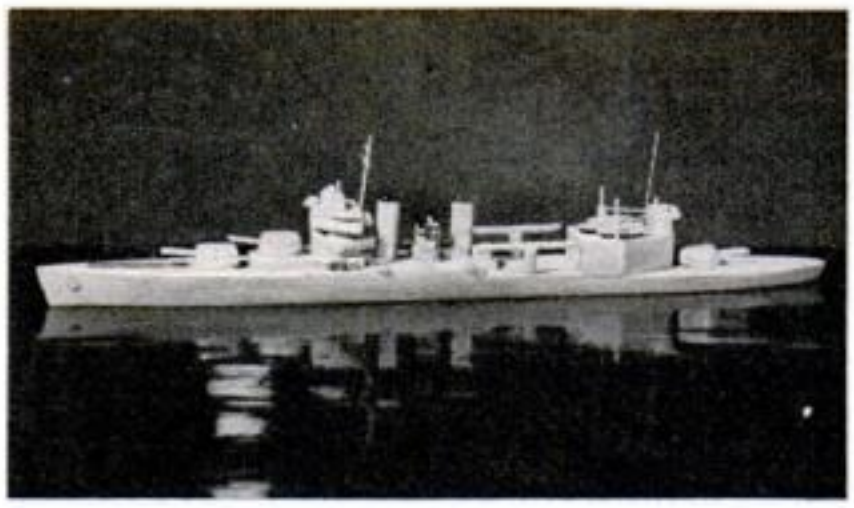

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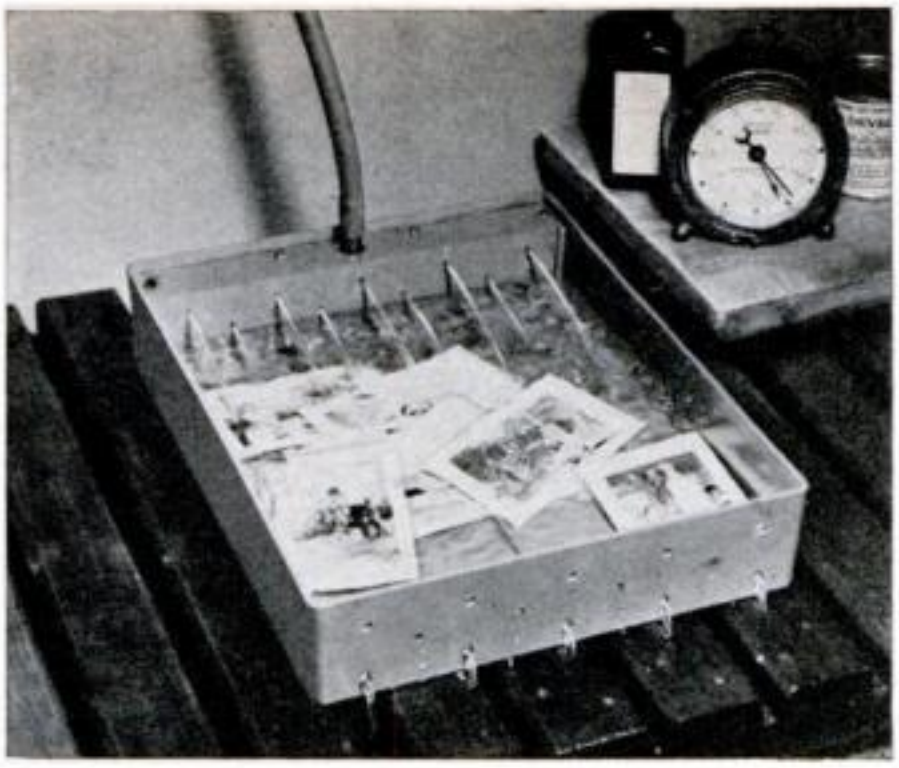

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How to Retouch Any Negative Without Risk of Ruining It

AMATEUR photographers who wish to retouch a negative without taking any chances of ruining it can do so in the following manner: Find an old negative that is practically clear—that is, one which has no image on it because of great underexposure, or no exposure at all. Place this back to back with the negative that needs retouching and join the two with small dabs of waterproof cement at the four corners. Then do the retouching on the emulsion side of the blank negative. Print in the usual manner, but give a little extra exposure if necessary.—FRANK SHORE.

Box Gutter Painted Under Rim with Aid of a Shoe Dauber

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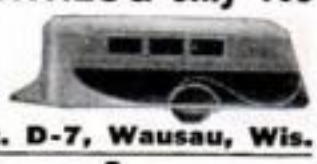

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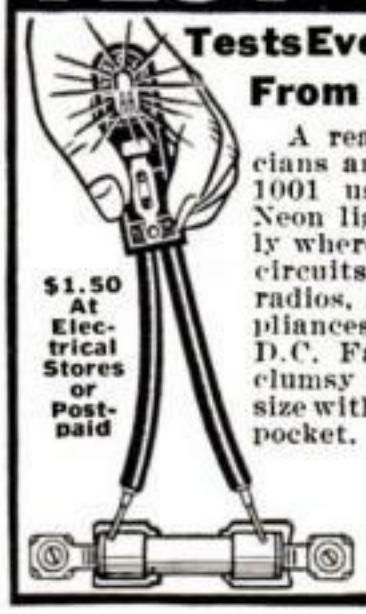

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(Continued on page 218)

Plans for the Workshop

(Continued from page 217)

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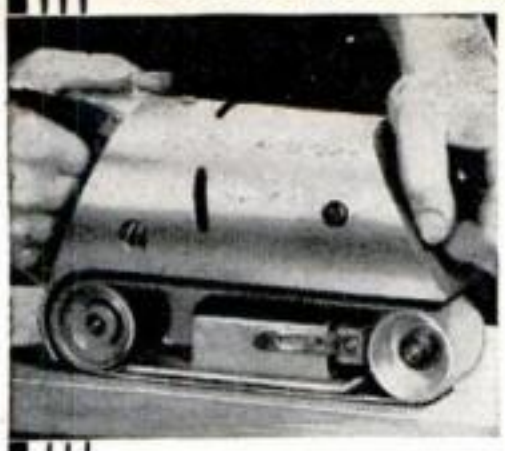

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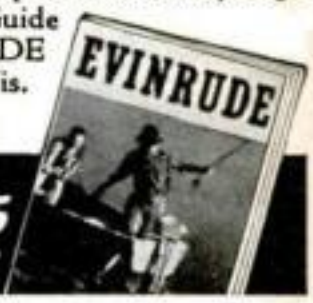

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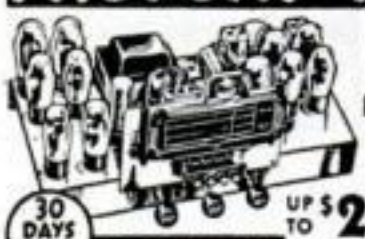

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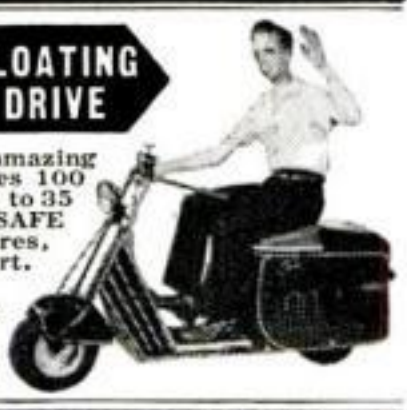

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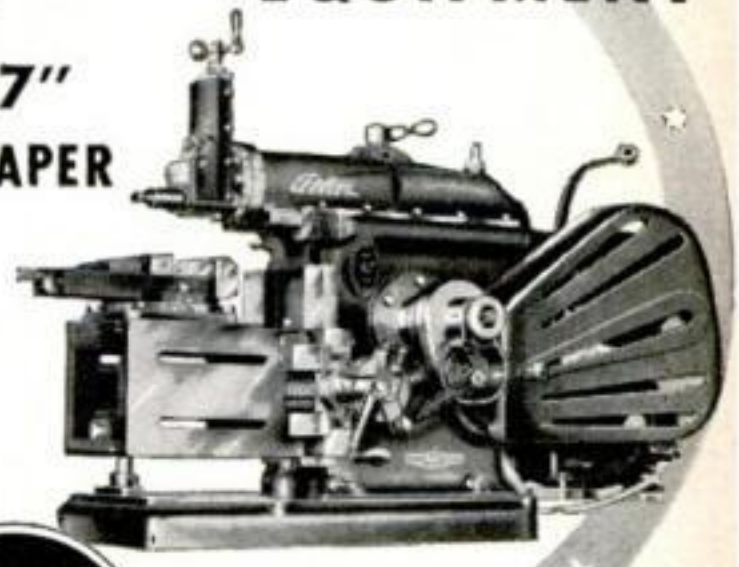

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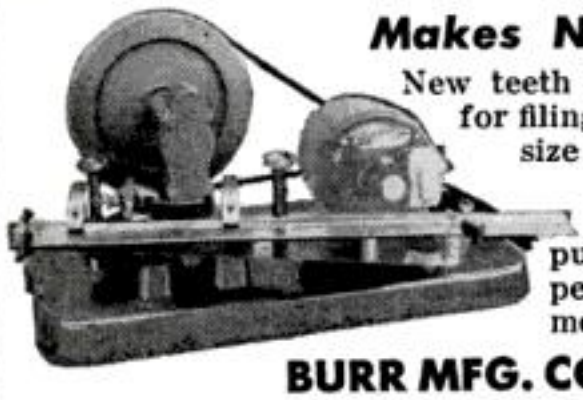

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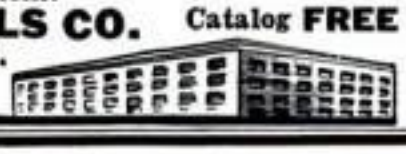

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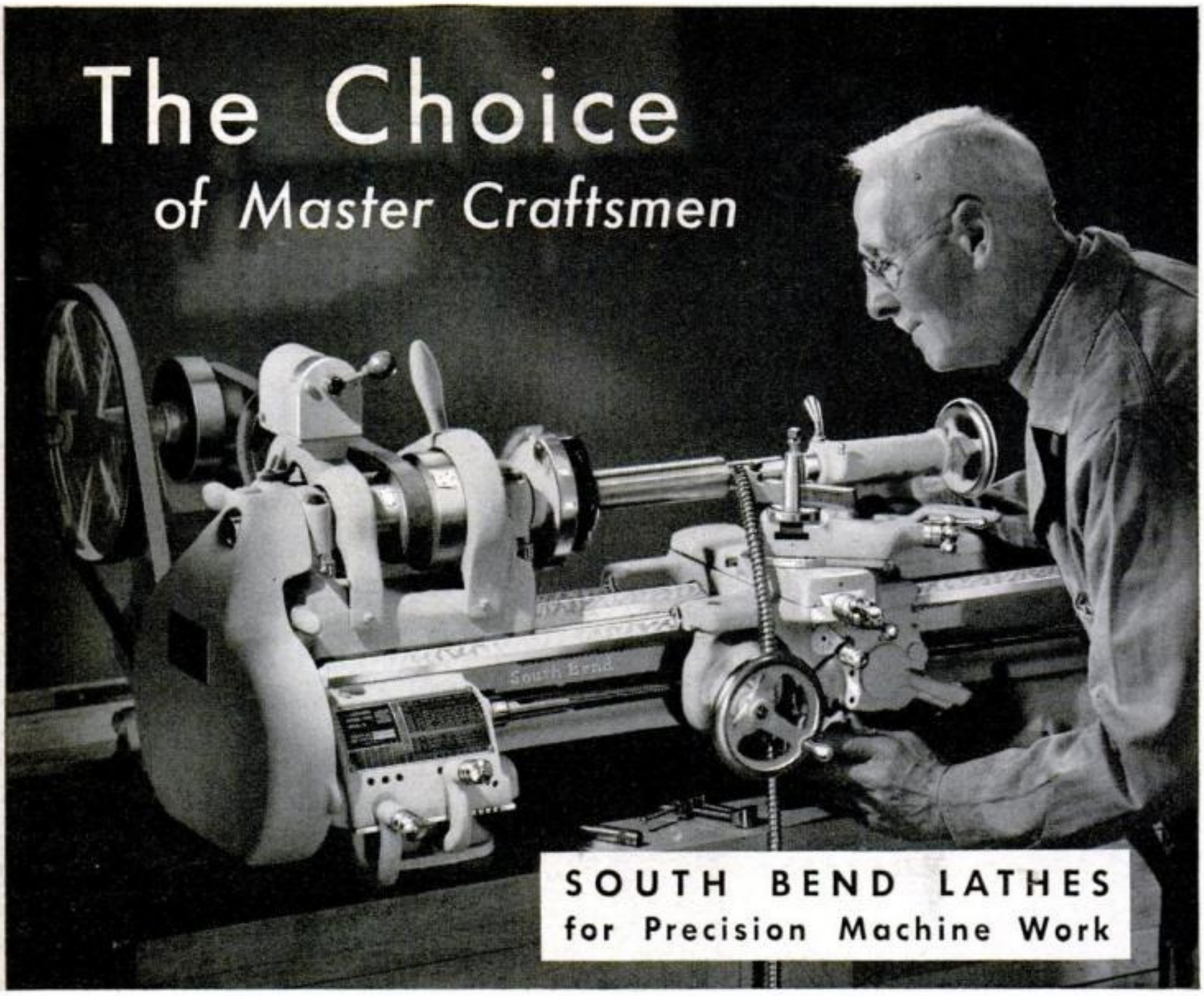

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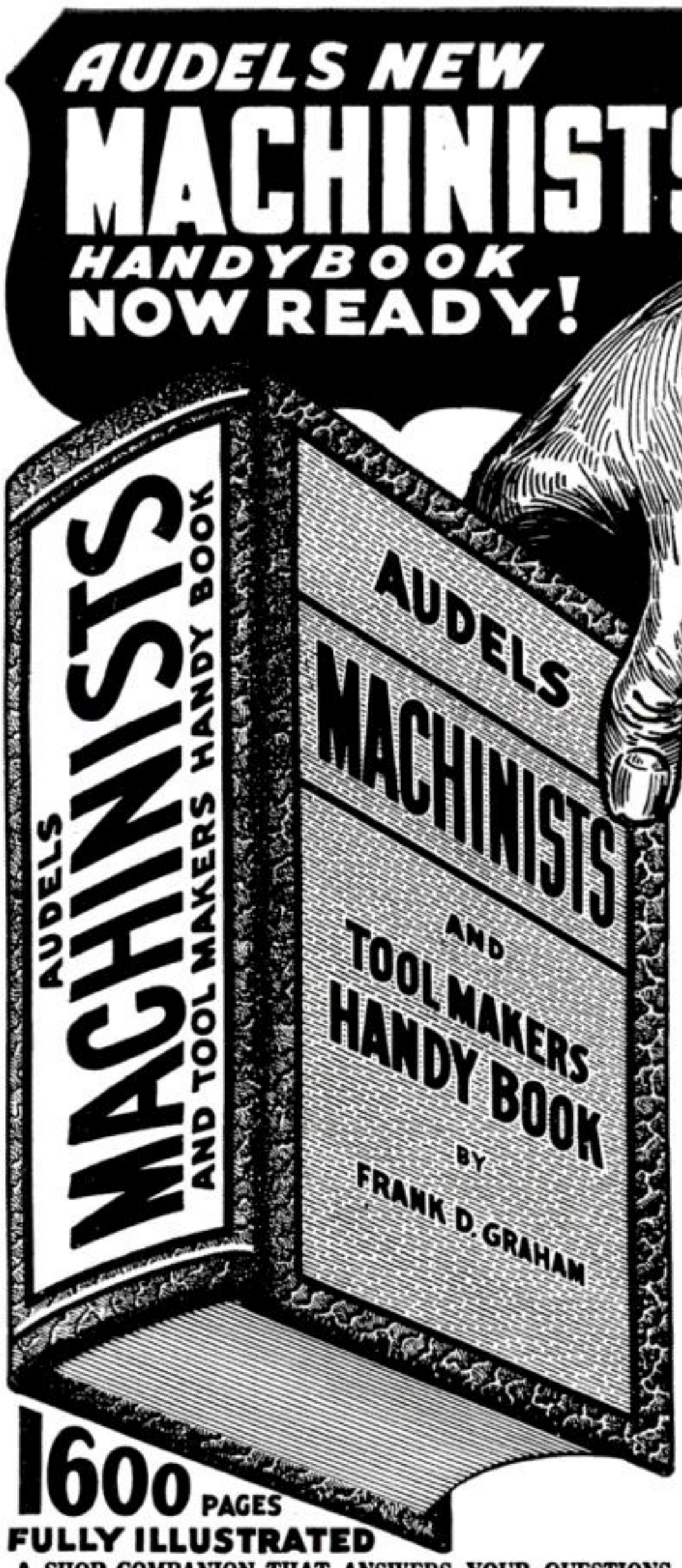

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